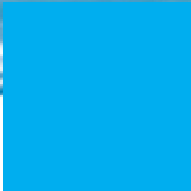
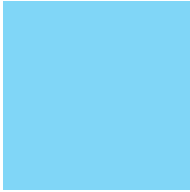
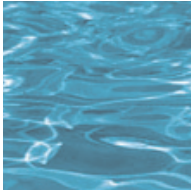




Appendix H

Lower Maungakotukutuku Geotech Feasibility

Interpretative Report
Factual Report



**Lower Maungakotukutuku Dam
Factual Geotechnical Report**

July 2010

Kapiti Coast District Council

Issue 1

Lower Maungakotukutuku Dam Factual Geotechnical Report

July 2010

Kapiti Coast District Council

Issue 1

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Approved for issue:


Stephen McInerney

Date

20/7/2010

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1.0 Introduction

This report summaries the results of reconnaissance level geological mapping, trial pitting and drilling carried out to investigate the suitability of the Maungakotukutuku Dam site.

The proposed Maungakotukutuku Dam is located on the Maungakotukutuku stream, a tributary of the Waikanae River as shown on Figure 1.1. The proposed dam and reservoir is a means of providing in-catchment storage to augment water supply during periods of low flow in the Waikanae River.

The dam site can be accessed from SH1 to Nikau Palm Rd, Maui Pomari Rd and to the end of Mahaki Rd from where a farm track leads to the Maungakotukutuku Valley upstream of the dam.

The dam site was identified in the late 90's and is located where the valley narrows downstream of a wider valley section. This takes advantage of the inherent reduced length of the dam in the narrow section and the increased volume of reservoir in the wider section of the valley. The dam site is approximately 3 km upstream of the confluence with the Waikanae River.

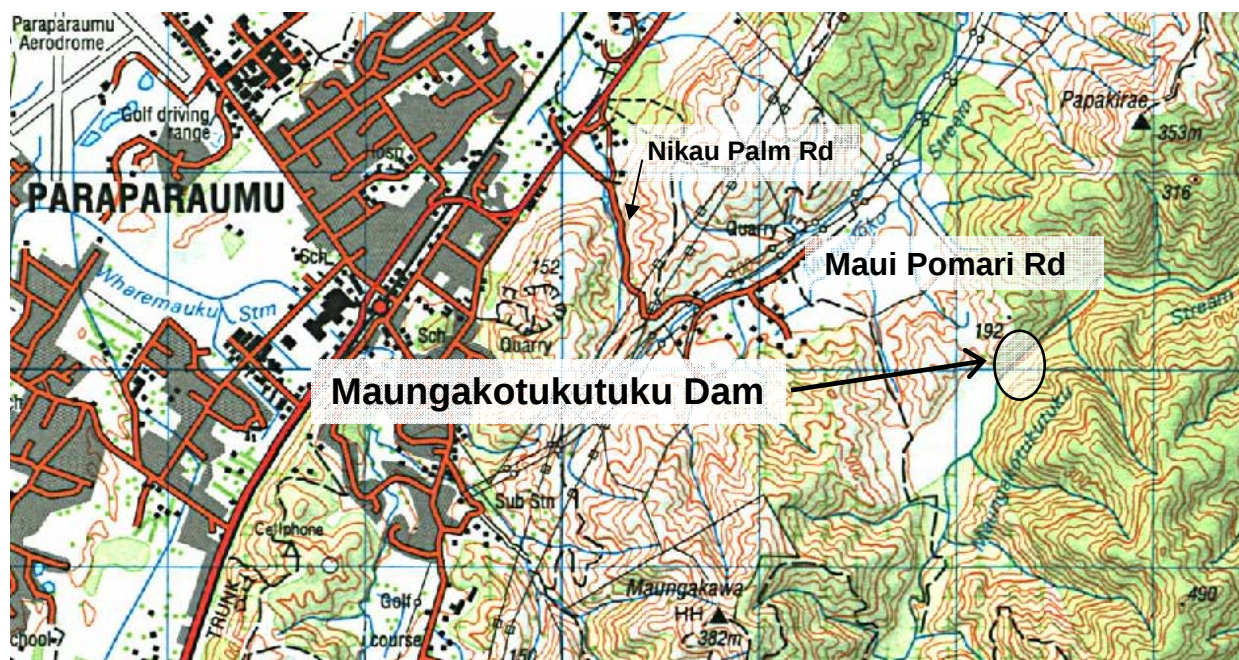


Figure 1.1. Maungakotukutuku Dam Site Location

2.0 Physiography

The dam site spans a section of narrow valley immediately downstream from a flat-floored basin. At the dam site the valley is approximately symmetrical with steep slopes extending above the proposed abutment from about RL 120 m. At the base of the valley there is an inner river gorge, approximately 10m deep, which traverses through the dam site and continues downstream.

Above the river gorge, the right bank has a well-developed alluvial terrace at about RL104 m. An equivalent terrace on the left bank is small and constrained in area.

There are two saddles on the NW perimeter of the proposed reservoir, which both constrain the top reservoir level and are potential seepage locations. Saddle locations are shown in Drawing WS909/20/27 REV0 included in Appendix A.

3.0 Dam Site Investigations

3.1 Geological Mapping

Reconnaissance level geological mapping was carried by Royden Thompson and Mark Anderson on the 12th of April 2010. The area inspected comprised; the dam site, a short distance up and downstream of the dam site and the ridge above the left abutment. Further inspection of the river gorge was undertaken by Andrew Kilby and Matthew Knox on the 14th of July 2010. The extent of the reconnaissance mapping is shown on the field maps included in Appendix B.

The basement rock in the area of the dam site and reservoir is greywacke. At this stage, no attempt has been made to differentiate the greywacke, or map variations within the greywacke in plan across the dam site.

Upstream of the dam (near point 34, figure 1a, Appendix B) the greywacke tends to be uniformly dark green, possible ferrous staining, and gives the impression that the mass has been previously strongly sheared, then rehealed.

The greywacke downstream towards the dam footprint tends to be hard, siliceous, and black while Sub vertical shear zones were also apparent within this area. Shear zones consisted of light grey pulverised rock with high clay content. An example of a shear zone is shown in Figure 3.1. The shear zones are between 100mm and 300mm wide and are aligned sub parallel to the axis of the proposed dam.

There was little obvious structure e.g. bedding, nor was there evidence of any low angle shear zones in the basement greywacke.

Terraces on both banks at the dam site are the result of previous river valley aggradation. Exposures on the right bank show approximately 3m of relatively fine alluvium. Wedges of river alluvium are present at the same level on the left bank.

Colluvium mantles the steeper slopes on the abutment areas. There is a small mass movement debris tongue which extends out onto the terrace approximately 60m upstream from the right abutment.

3.2 Drilling

Five continuous rotary core drillholes were drilled in the dam foundation to explore the depth of overburden, quality of bedrock and presence of active faulting.

Drillhole locations are shown on Drawing WS909/20/25 included in Appendix A. Drillhole logs are included in Appendix C. Core photographs are included in Appendix D.

Drill hole details and observations are summarised in Table 3.2.

Two helicopter transportable wire line rigs operated by Websters Drilling Ltd., carried out the drilling using HQ sized triple tube wireline equipment and HW casing.

Drilling was supervised on site by Damwatch. Core was wrapped and packaged in plastic core boxes before being transported to Websters Drilling Ltd yard in Porirua. Core logging and photography was performed by Royden Thompson.

Drillholes LM1 to LM4 inclusive were grouted upon completion with cement grout. Drillhole LM5 was grouted within the greywacke with a 32mm standpipe piezometer installed within the overlying alluvium and colluvium. As built standpipe piezometer details are included in Appendix C.



Figure 3.1. Shear Zone

3.3 Lugeon Tests

Lugeon tests were carried out over sections of the drill holes using single packers. A total of fourteen lugeon tests were undertaken. A summary of Lugeon test results is tabulated in Appendix E.

Testing was carried out using both pneumatic and hydraulic packers. Based on field inspection of the rock core, sections were chosen progressively as the hole was advanced to target zones of highly fractured rock. These zones were anticipated to be of higher permeability.

Testing was carried out by Websters Drilling Ltd and supervised by Damwatch.

Table 3.2. Summary of Drillhole Details and Observations

Hole Number	Details	Geologic Summary
LM-1	Vertical hole to 20.0m depth. Located on left abutment. Grouted on completion.	• 0.35m to 5.87m colluvium. • 5.87m to 20.0m predominately sandstone dominated, siliceous Greywacke. • Pervasive green alteration. • Zones of mostly indurated, pervasive shearing, assumed to be 'old'. • No distinct bedding. • Generally closely to very closely spaced defects of variable orientation.
LM-2	Drilled 34.37m in length, 70° from horizontal at a bearing of 149°. Located on left abutment. Grouted on completion.	• 0.0m to 1.30m river alluvium. • 1.30m to 34.37m greywacke of variable quality. • Rock ranges from strong sandstone dominated, siliceous greywacke to weaker argillaceous zones. • Limited patchy green alteration • Zones of high core loss with very grey muddy drill flush returns. Inferred shear zones infilled by crushed/pulverised rock and clay gouge. • No defined low angle shears.
LM-3	Drilled 54.03m in length, 45° from horizontal at a bearing of 329°. Located on right abutment. Grouted on completion.	• 0.0m to 9.40m river alluvium. • 9.40m to 54.03m generally sandstone dominated greywacke with very minor argillite and quartz veining. • Bedding obscure and only rarely identifiable. • Well jointed and sheared rock with minor oxidation at the top. • No defined low angle shears. • Patchy, but subordinate alteration in the greywacke.
LM-4	Vertical hole drilled to 14.93m depth on the right abutment. Grouted on completion.	• 0.35m to 5.10m river alluvium. • 5.10m to 14.93m generally sandstone dominated greywacke with diffuse, patchy, argillite. • Closely jointed and sheared. • No defined low angle discontinuities.
LM-5	Vertical hole drilled to 17.02m depth on right abutment. PVC standpipe and steel standup cover installed on completion.	• 0.20m to 3.15m Loess with colluvium detritus. • 3.15m to 9.14m river alluvium. • 9.14m to 17.02m generally sandstone dominated, siliceous Greywacke. • Closely jointed and sheared. • No defined low angle discontinuities.

4.0 Saddle Investigation

4.1 Road Saddle

Two trial pits were excavated using a 20 tonne excavator on the 'road saddle'. Test pit locations are shown on Drawing WS909/20/27 in Appendix A. Test pit photographs and logs are included in Appendix F.

Test pit MA-1 on the NW side of the saddle revealed greywacke at 3.90m below ground level overlain by Loess. The greywacke surface rises towards the saddle. In test pit MA-2 alluvium with a loess cover was encountered to the final depth of 4.1m. Alluvium with a loess cover also exists in the south west road batter at the saddle. No groundwater was encountered in test Pit MA-1. Small groundwater inflows at 2.70m depth were encountered in MA-2. After completion test pits were backfilled with excavated material and compacted with the excavator bucket. All excavated material was returned to the excavated pits.

A sketch geological section through the saddle based on the test pits is shown in Figure 4.1.

The level RL 120m was estimated on site based on topographic mapping and requires confirmation by survey control.

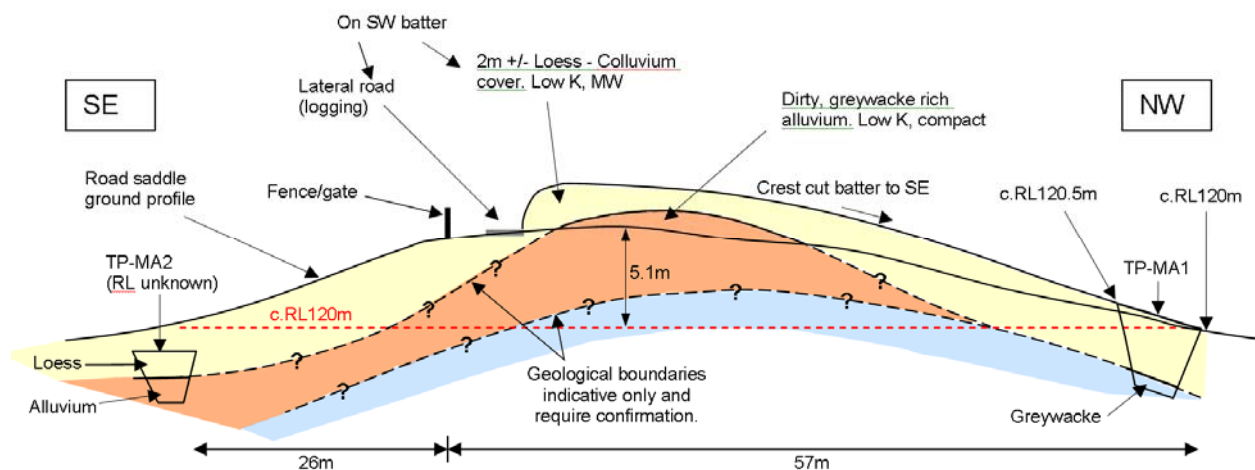


Figure 4.1. Road Saddle Profile

4.2 Pond Saddle

Approximately 150m NW of the dam centre there is another low saddle containing a long narrow pond that has a low embankment at both ends. This saddle is shown in Figure 4.2.

Although no trial pitting was undertaken, greywacke was observed outcropping in the track cuts on either side of the saddle gully.

To gain a better understanding of the pond saddles potential for overtopping, levels and accurate topographic data need to be established for the pond saddle.

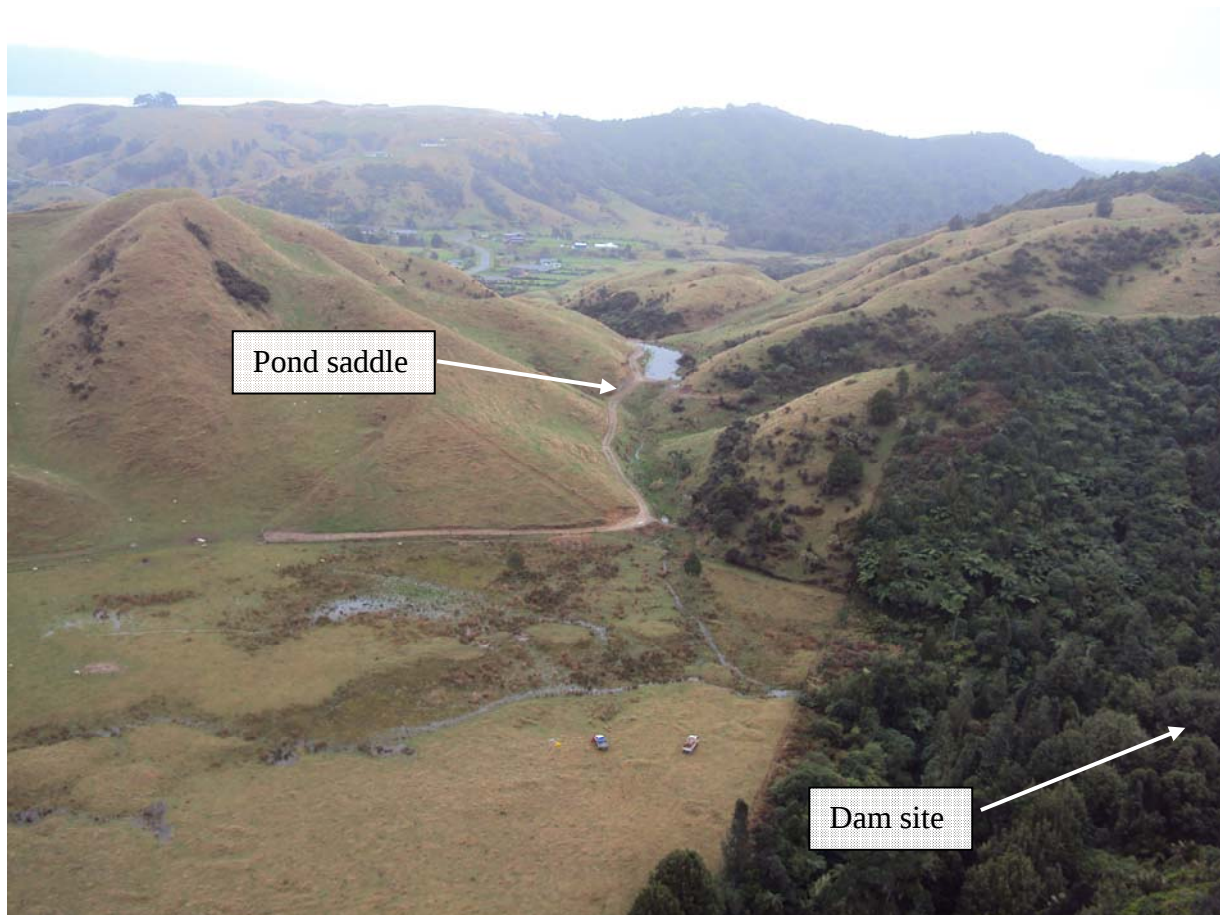


Figure 4.2. Pond Saddle Location.

5.0 Borrow Areas

5.1 Test Pits

Three test pits were excavated, using a 20 tonne excavator, in cultivated land in the Maungakotukutuku Basin to investigate the river alluvium and greywacke bedrock as a potential aggregate. Test pit locations are shown on WS909/20/27 in Appendix A, with test pit photographs and logs in Appendix F.

Test pit MA-3 and MA-4 established the presence of alluvium greater than 4m thick in the mid basin area. While greywacke clasts are relatively fresh and strong, the alluvium tends to have high silt/clay content. Fines would be required to be removed by washing if it is to be used as an aggregate. Small groundwater seeps were only encountered in test pit MA-3 at 3.2m.

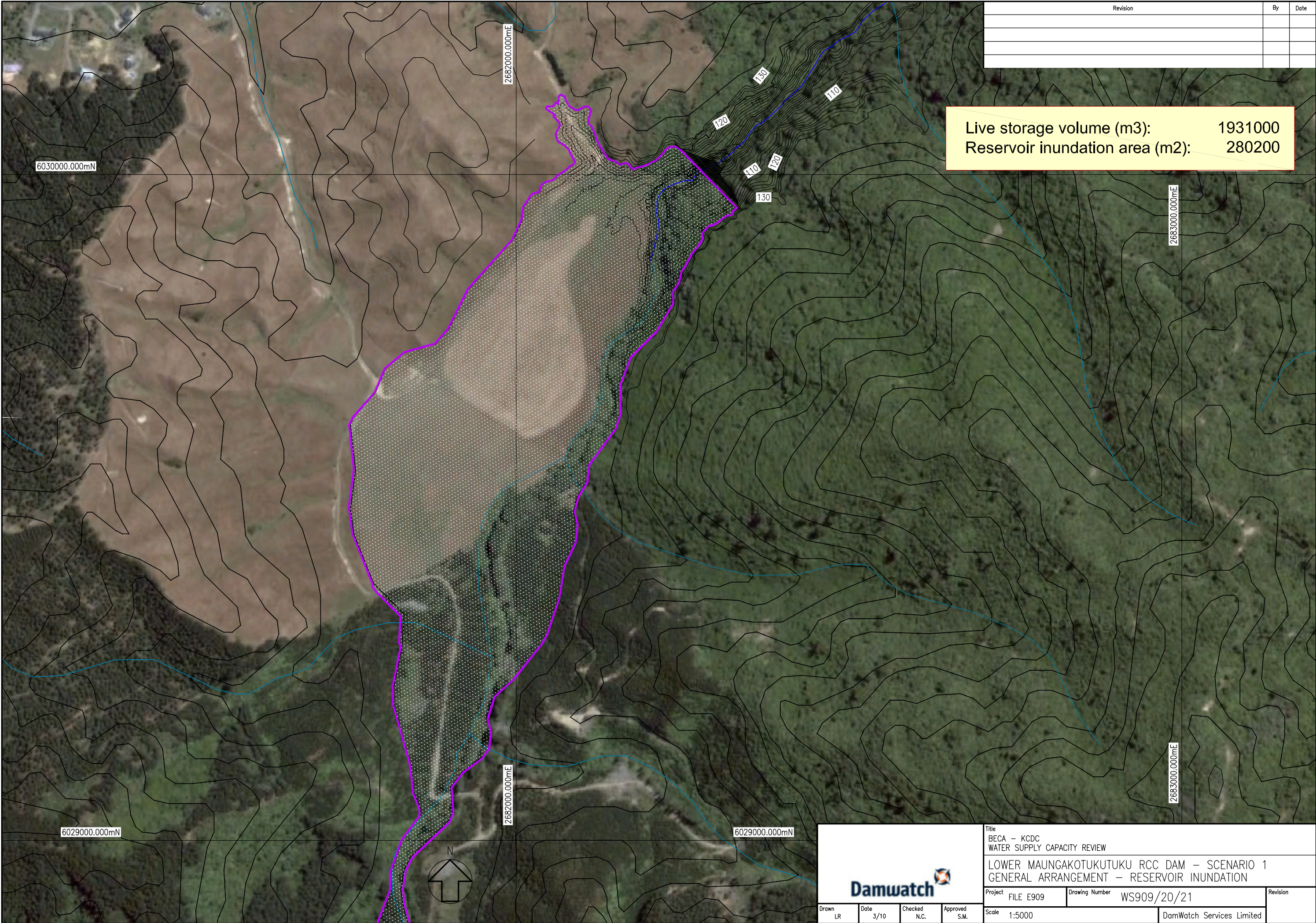
Test pit MA-5 encountered greywacke at a depth of 2.6m. Greywacke is slightly weathered, closely jointed and blocky. There is some penetration of fines along defects.

In close proximity to MA-5 the grassy area is rough, lower in elevation and moist suggesting greywacke may be present with minimal overburden.

Test pits were photographed and logged by Royden Thompson, before backfilling and compaction on completion.

Appendix A: Drawings

WS909/20/21	Lower Maungakotukutuku RCC Dam – Scenario 1 - General Arrangement – Reservoir Inundation
WS909/20/22	Lower Maungakotukutuku RCC Dam – Scenario 1 – Plan and Typical Sections
WS909/20/23	Lower Maungakotukutuku RCC Dam – Scenario 2 - General Arrangement – Reservoir Inundation
WS909/20/24	Lower Maungakotukutuku RCC Dam – Scenario 2– Plan and Typical Sections
WS909/20/25 R4	Lower Manugakotukutuku Dam – Geotechnical Drilling Setting Out
WS909/20/27	Lower Manugakotukutuku Dam – Test Pit Locations



Revision	By	Date

Live storage volume (m3): 1931000
Reservoir inundation area (m2): 280200

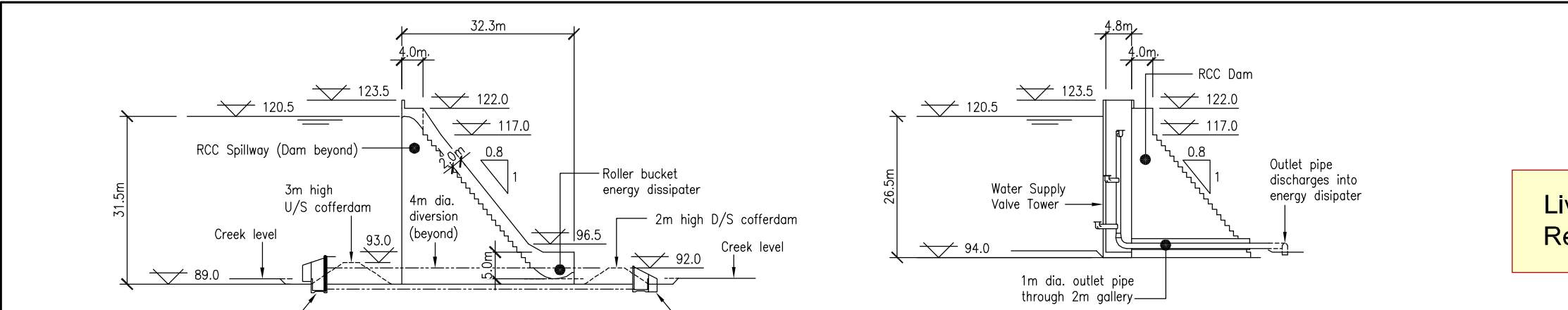
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Graphic Scales 1:5000 0 40 80 120 160 200 240 m

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				LOWER MAUNGAKOTUKUTUKU RCC DAM – SCENARIO 1 GENERAL ARRANGEMENT – RESERVOIR INUNDATION	
Project	FILE E909	Drawing Number	WS909/20/21		Revision
Scale	1:5000		DamWatch Services Limited		
Drawn	LR	Date	3/10	Checked	N.C.
Approved	S.M.				

200 mm
100
50
10 mm
0

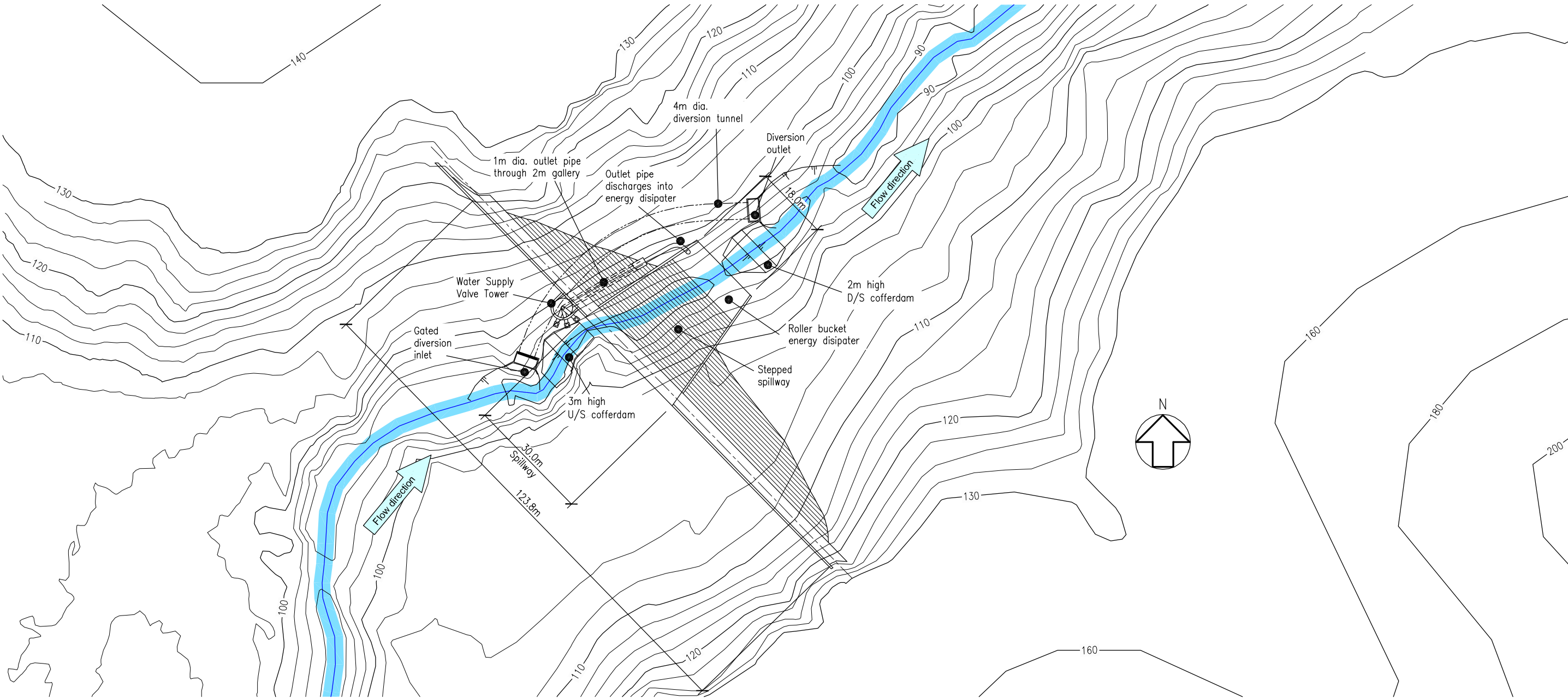
20 May 2010 4:18pm



SPILLWAY CROSS SECTION

WATER SUPPLY CROSS SECTION

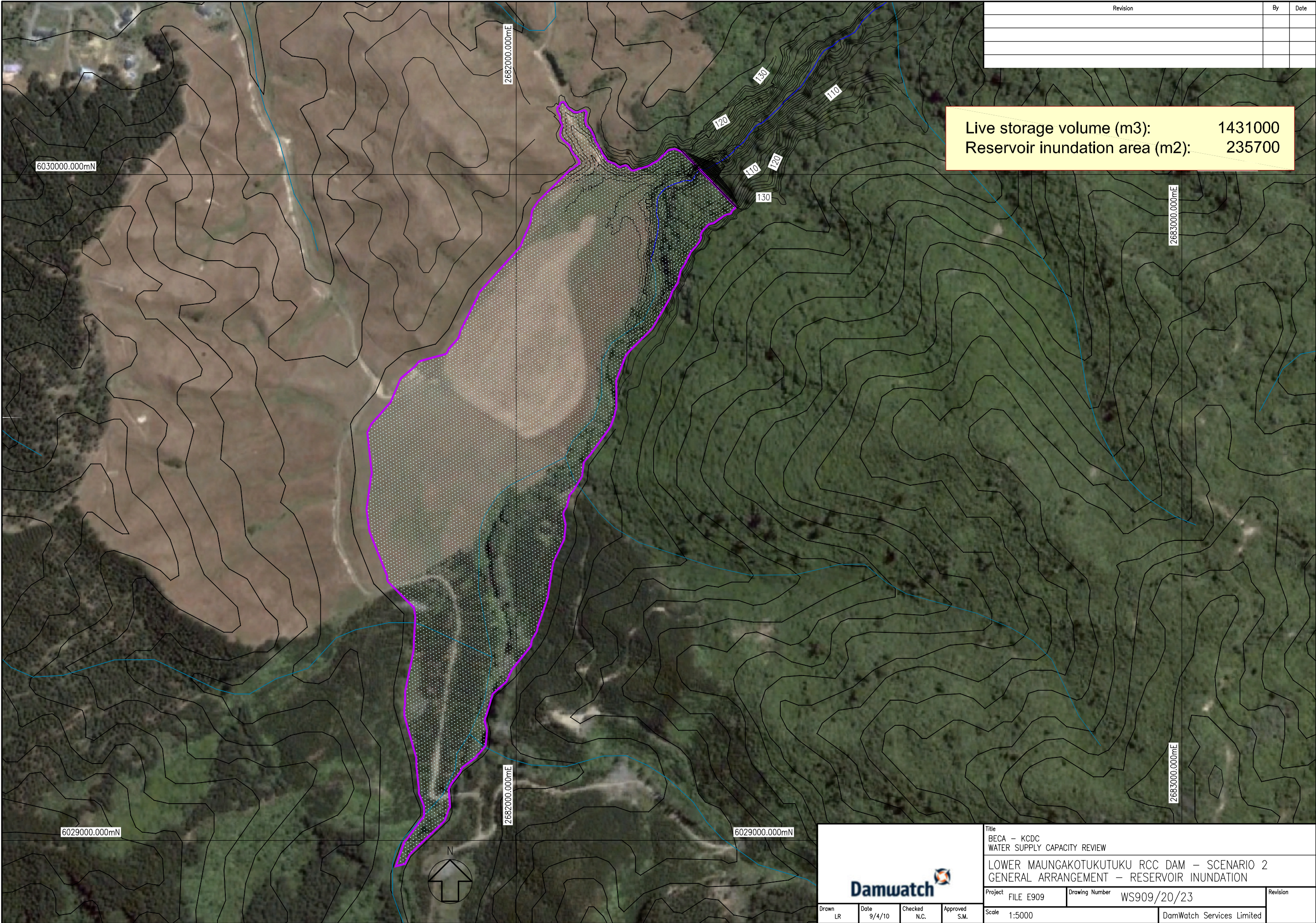
Live storage volume (m3): 1931000
Reservoir inundation area (m2): 280200



PLAN

Graphic Scales 1:1000 0 10 20 30 40 50 m

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	LOWER MAUNGAKOTUKUTUKU RCC DAM – SCENARIO 1 GENERAL ARRANGEMENT – PLAN AND TYPICAL SECTIONS		
Project	FILE E909	Drawing Number	WS909/20/22
Scale	1:1000	DamWatch Services Limited	
Drawn	Date	Checked	Approved
LR	3/10	N.C.	S.M.



Revision	By	Date

Live storage volume (m3): 1431000
Reservoir inundation area (m2): 235700

20 May 2010 4:18pm

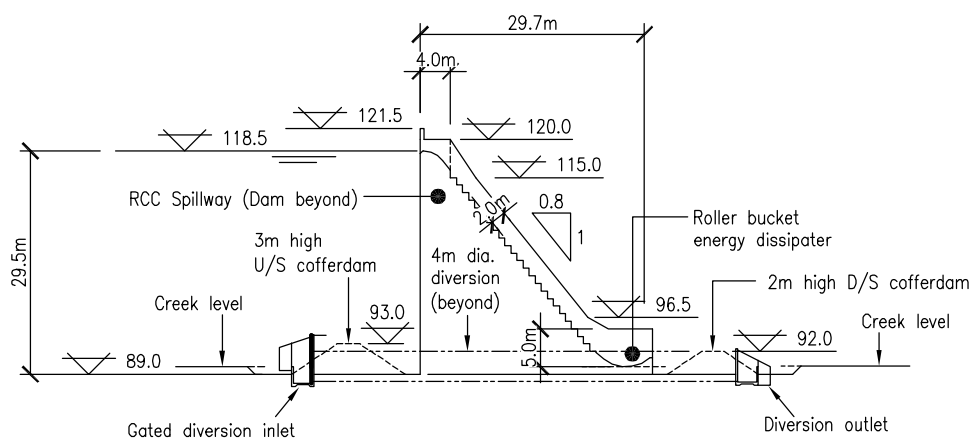
				Title BECA – KCDC WATER SUPPLY CAPACITY REVIEW	
				LOWER MAUNGAKOTUKUTUKU RCC DAM – SCENARIO 2 GENERAL ARRANGEMENT – RESERVOIR INUNDATION	
Project FILE E909		Drawing Number WS909/20/23			Revision
Drawn LR	Date 9/4/10	Checked N.C.	Approved S.M.	Scale 1:5000	DamWatch Services Limited

Graphic Scales 1:5000 0 40 80 120 160 200 240 m

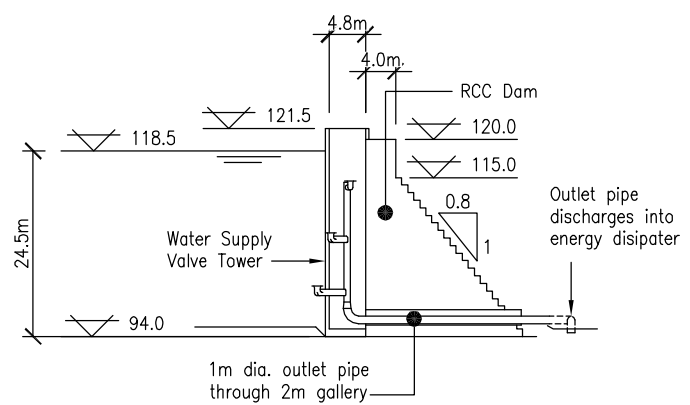
200 mm
100
50
10 mm
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20 May 2010 4:21pm

Graphic Scales 1:1000 0 10 20 30 40 50 m

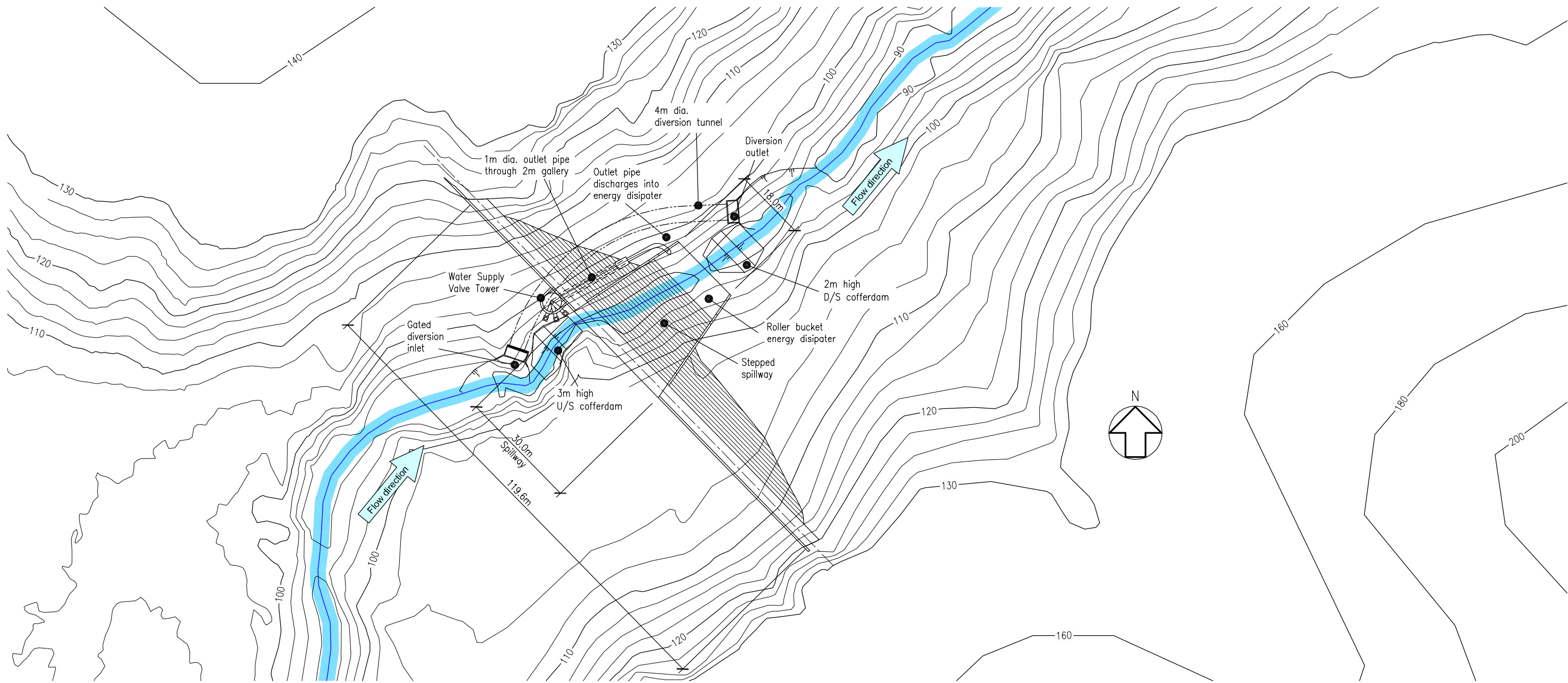


SPILLWAY CROSS SECTION



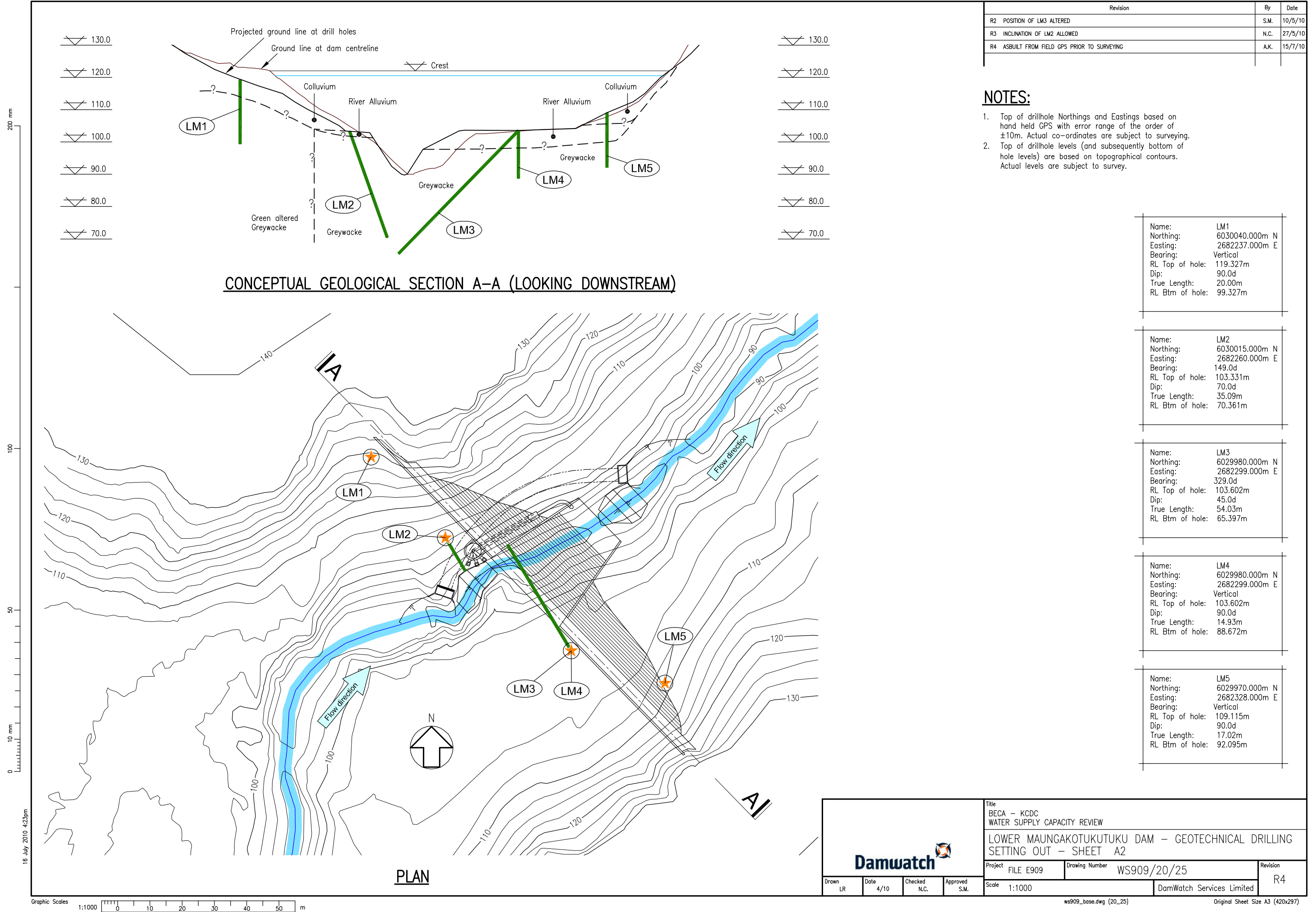
WATER SUPPLY CROSS SECTION

Live storage volume (m3): 1431000
Reservoir inundation area (m2): 235700



PLAN

	Title BECA – KCDC WATER SUPPLY CAPACITY REVIEW		
	LOWER MAUNGAKOTUKUTUKU RCC DAM – SCENARIO 2 GENERAL ARRANGEMENT – PLAN AND TYPICAL SECTIONS		
	Project FILE E909	Drawing Number WS909/20/24	Revision
Drawn LR	Date 9/4/10	Checked N.C.	Approved S.M.
Scale 1:1000		DamWatch Services Limited	



Revision	By	Date
R2 POSITION OF LM3 ALTERED	S.M.	10/5/10
R3 INCLINATION OF LM2 ALLOWED	N.C.	27/5/10
R4 ASBUILT FROM FIELD GPS PRIOR TO SURVEYING	A.K.	15/7/10

NOTES:

- Top of drillhole Northings and Eastings based on hand held GPS with error range of the order of ±10m. Actual co-ordinates are subject to surveying.
- Top of drillhole levels (and subsequently bottom of hole levels) are based on topographical contours. Actual levels are subject to survey.

Name:	LM1
Northing:	6030040.000m N
Easting:	2682237.000m E
Bearing:	Vertical
RL Top of hole:	119.327m
Dip:	90.0d
True Length:	20.00m
RL Btm of hole:	99.327m

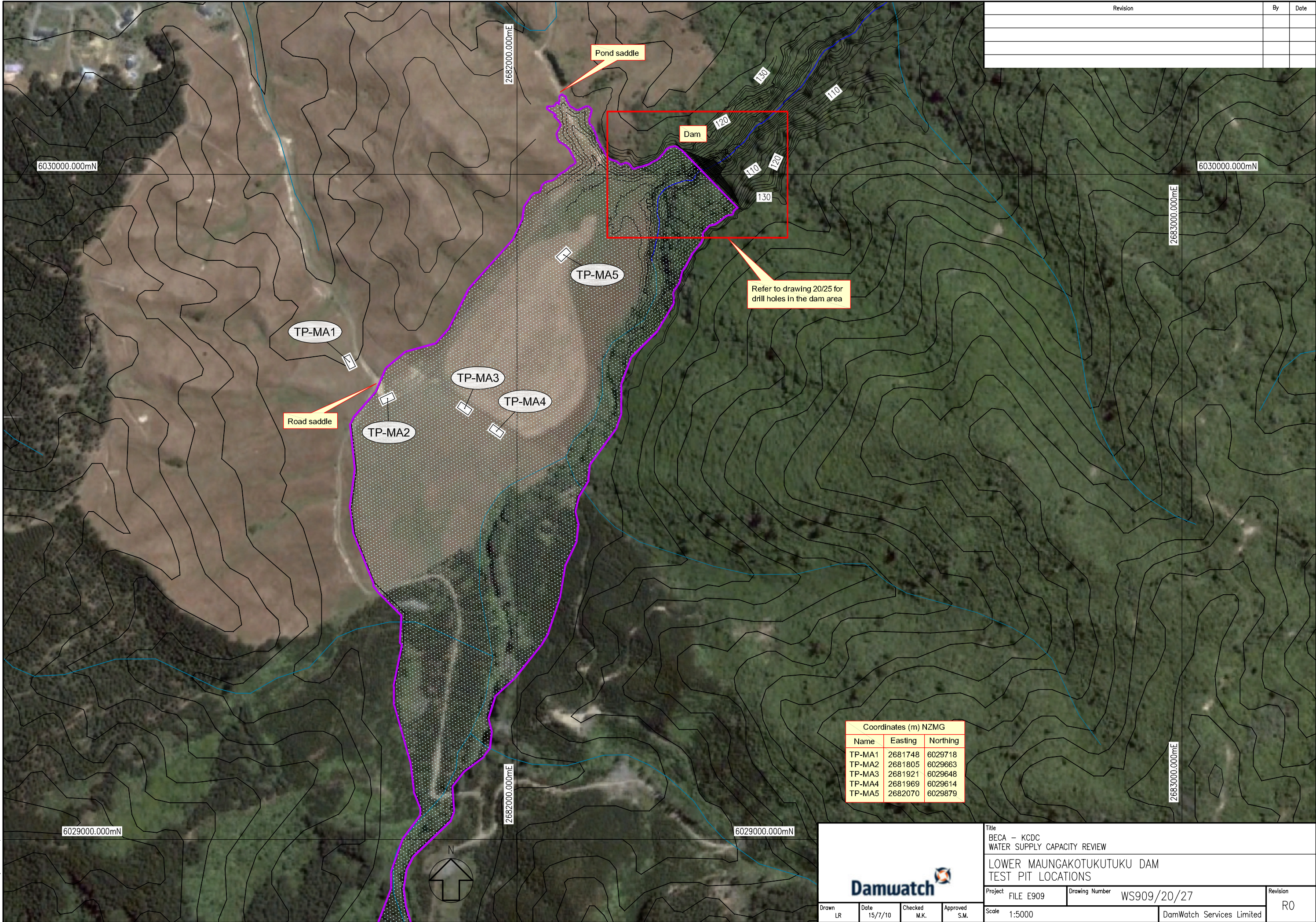
Name:	LM2
Northing:	6030015.000m N
Easting:	2682260.000m E
Bearing:	149.0d
RL Top of hole:	103.331m
Dip:	70.0d
True Length:	35.09m
RL Btm of hole:	70.361m

Name:	LM3
Northing:	6029980.000m N
Easting:	2682299.000m E
Bearing:	329.0d
RL Top of hole:	103.602m
Dip:	45.0d
True Length:	54.03m
RL Btm of hole:	65.397m

Name:	LM4
Northing:	6029980.000m N
Easting:	2682299.000m E
Bearing:	Vertical
RL Top of hole:	103.602m
Dip:	90.0d
True Length:	14.93m
RL Btm of hole:	88.672m

Name:	LM5
Northing:	6029970.000m N
Easting:	2682328.000m E
Bearing:	Vertical
RL Top of hole:	109.115m
Dip:	90.0d
True Length:	17.02m
RL Btm of hole:	92.095m

Title		BECA – KCDC WATER SUPPLY CAPACITY REVIEW	
Project		FILE E909	
Drawing Number		WS909/20/25	
Scale		1:1000	
Drawn		LR	
Date		4/10	
Checked		N.C.	
Approved		S.M.	
Revision		R4	

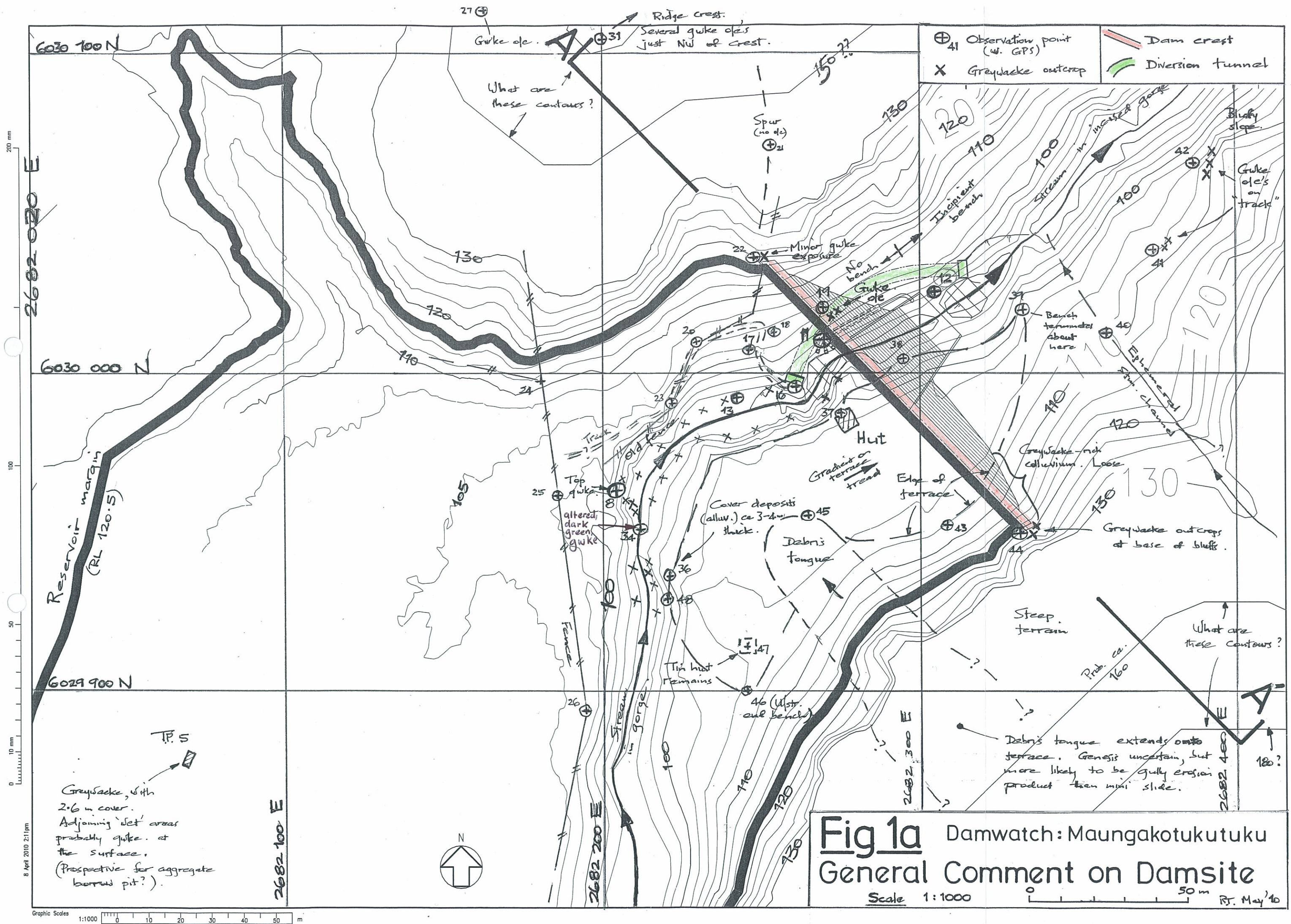


Revision	By	Date

Name	Easting	Northing
TP-MA1	2681748	6029718
TP-MA2	2681805	6029663
TP-MA3	2681921	6029648
TP-MA4	2681969	6029614
TP-MA5	2682070	6029879

Damwatch 				Title BECA – KCDC WATER SUPPLY CAPACITY REVIEW			
				LOWER MAUNGAKOTUKUTUKU DAM TEST PIT LOCATIONS			
				Project FILE E909		Drawing Number WS909/20/27	
Date 15/7/10	Checked M.K.	Approved S.M.	Scale 1:5000		DamWatch Services Limited		

Appendix B: Reconnaissance Field mapping



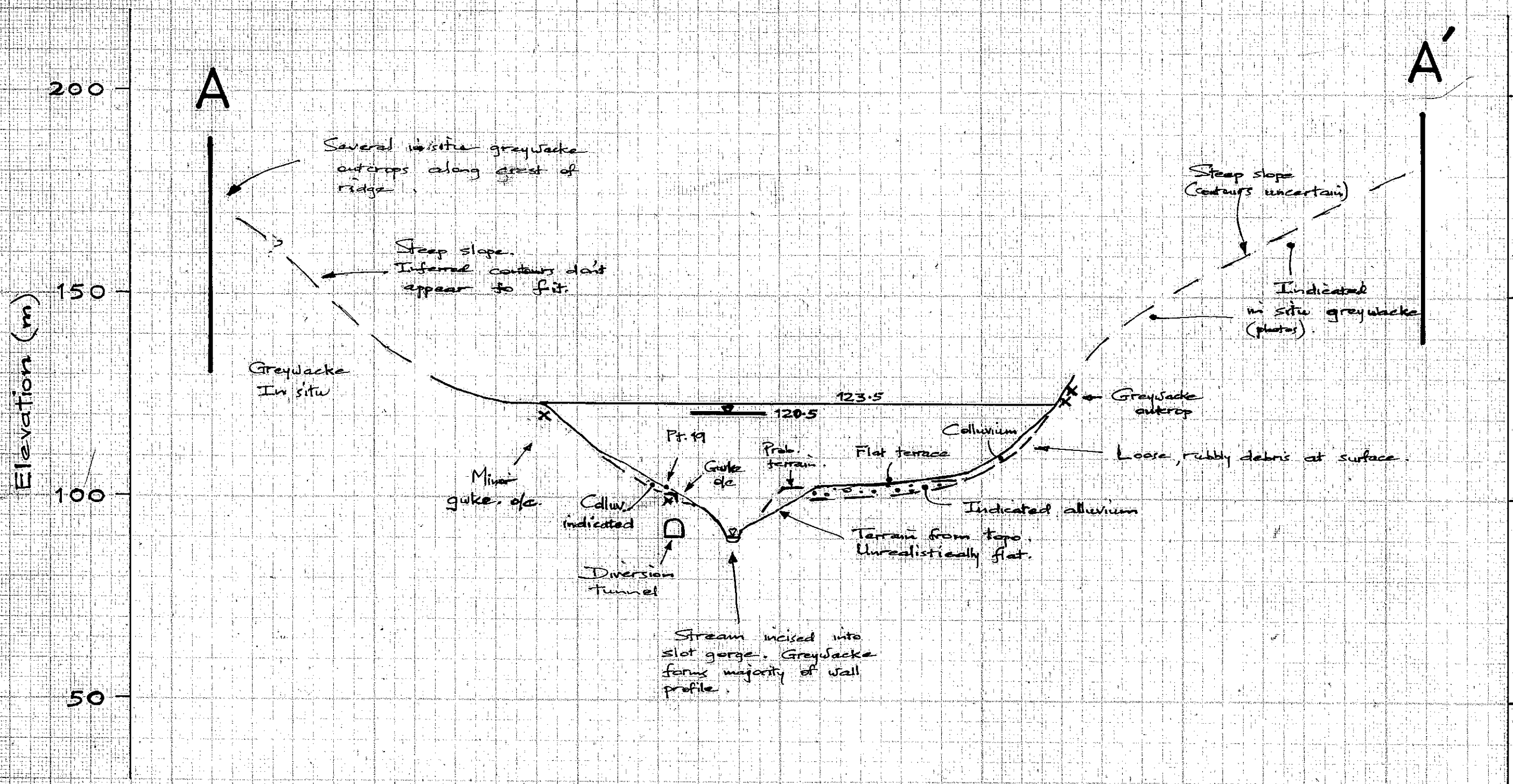


Fig. 1b Geological Section on Dam Axis

Scale 1:1000, H=V

R.T.
May '40

Appendix C: Drill Hole Logs

LM 1

LOCATION LOWER MAUNGAKOTUKUTUKU

DATUM T.B.C

H.A.D. COLLAR

10⁻⁶ cm/s

Rubby frags.
 Shear Pulv. w. clay matrix
 Dip @ 45°? V. soft.
 Intensely sheared (old).
 Readily disagg. w. Knife.
 V. Soft — malleable.
 Tends to fracture at ca. 35°
 Loss assumed not to core length
 sheared core.
 Hard frags. — rubble.
 "old"
 Intensely sheared & but
 firm/compact. Disaggregates
 with knife / fingers. Weak!
 w. w. eak. "Felon" @
 Loss. ca. 35° to core axis

DRG NO

Damwatch Services

HOLE NO.

LM 1

LOG OF DRILL HOLE

PROJECT **KCOC** FEATURE **DAM FOOTPRINT** LOCATION **LOWER MAUNGAKOTUKUTUKU**

GRID REF. **T.B.C** CO-ORD. **T.B.C** DATUM **T.B.C**

ANGLE FROM HORIZONTAL **90°** DIRECTION **—** H.A.D. GROUND **T.B.C** H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Piezometers	CORE RECON LIFT % 50 100	DEPTH H.A.D. Core size, casing m	LOG GRAPHIC	FRACTURE LOG (Spacing of natural fractures) 50 10 5 1 0.1 cm	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.Q.D. % Date	WATER LEVEL WATER LOSS % 0-100	WATER PRESSURE TESTS - Lugeons or PERMEABILITY-10 ⁶ cm/s 0 1 10 100 1000
Siliceous core remnants. Weak condition, plus clay in matrix, suggests shear is locally of more recent genesis. Siliceous. Fine qtz. Veining. Poss. bdg. -60 dk med. green alteration dk khaki Pervasive oxid. Soft shear suggests same more recent reactivation. Gulke, hard, siliceous. Numerous qtz. Veins. Gulke frags. hard, siliceous, w. qtz. Veining.											
								Loss assumed in compact shear (prob. grinding)			
								Hard, rubbly frags.			
								Shear Intensely deformed, compact, indurated. Weak/soft. Preserved frags. @ ca. 20° to core length. Slick'd.			
								Shear Intensely crushed. clay soft. Attitude uncertain.			
								Fracture @ 45° to core			
								Shear at low 45° to axis.			
								core. Pulverised.			
								Rubble. Some slick'd surfaces.			
								Jts. tend rough, slick'd. (sheared)			
								Frags. tend smooth, polished. 45° to core			
								Gulke drg. induced?			
								Slick'd jts. 75° to core axis			
								Thin shear / slick'd planar jts.			
								Insp. sheared, weak core.			
								Basal dip 25°?			
								Sld jts. @ 15/20°. Sheared.			
								Fresh core bk. sheared			
								Insp. sheared. Core tends intact & rel. sound.			
								Shear Strongly deformed to pulverised. Firm to soft. Internal plane at 45° dip.			
								Fine fragmented / crushed rk. oxidised - dk. brn			
								Hangingwall dip at 50°.			
								Shear Highly pulverised. V. weak. Soft.			
								Jts. slick'd, w. crush chgs.			
								Core v. weak.			
								Dips generally steep (45-70°).			
								H. wall dip 75°			
								Shear Pulverised. V. soft.			
								Sld. surfaces.			
								Footwall dip 25°			
								Core bks. sld.; thin crush.			
								Variable, thin shears. Core weak.			
								Shear Pulverised. Slick'd. V. soft. Steep.			
								H. wall dip. ca. 25°.			
								Shear Pulverised. Soft/V. soft. Strike unknown.			
								Shear Firm, compact core w. developing pseudojts. but can be readily disaggregated w. knife and fingers. Weak			
								"Contact" 30°? Vague.			
								Siliceous rk. frags.			
								High L. Contact.			
								Shear Intensely pulverised w. slick's. Soft/V. soft - can locally indent w. fingers. (13.7-13.8).			
								Footwall dip 45°.			
								H. wall dip 20°.			
								Shear Intensely pulverised. Compact. Firm. Indurated - bk. w. knife.			
								F. wall dip. ca. 50°			
								Shear Intensely pulverised. Tends soft, weak.			

STAGE	TESTING (m/s)	LUCEONS
1	11.25	0
2	2.79	0
3	2.98	0
4	2.29	0
5	11.25	0

* For water level at 1.0m b.g.l

DRILLER: WEBSTERS LTD STARTED: 14/6/16 FINISHED: 18/6/16 DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) Spacing of natural fractures Fractures/m of core	LOGGED: R.T DATE: 18/6/16 TRACED: 18/6/16 CHECKED: 18/6/16 ORIGINAL VERTICAL: 18/6/16 SCALE: 1:100 SHEET 2 OF 3	PROJECT: KCOC HOLE NO: LM-1 LENGTH: 20.00 CORE BOXES: 7 DRG NO:
---	--	--	---	---	---

Damwatch Services

LOG OF DRILL HOLE

HOLE NO.

LM 2

PROJECT KCDC FEATURE DAM FOOTPRINT LOCATION LOWER MAUNGAKOTUKUTUKU

GRID REF. CO-ORD. T.B.C DATUM T.B.C

ANGLE FROM HORIZONTAL 70° DIRECTION 149° H.A.D. GROUND T.B.C H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MS S	Piezometers	CORE RECOVERY LIFT %	DEPTH H.A.D. Core size casing m	LOG GRAPHIC	FRACTURE LOG (Spacing of natural fractures) 50 10 5 1 cms	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.Q.D. % Date	WATER LEVEL WATER LOSS %	WATER PRESSURE TESTS - Lugeons or PERMEABILITY-10 ⁻⁶ cm/s
0 - 1.30 <u>River Alluvium</u> Humus-rich Subrounded gneiss clasts in a soft clay/silt/sd matrix. High loss.								Approx. 50:50 subrd. clasts and fines.			
1.30 - T.D. <u>Greywacke</u> Essentially SST. Any pre-existing argillite now local and smeared out. Bedding vague to non-existent. Probably at low L to core length (ie steep dip)								Look, washed clasts subrd. Closely jtd. to finely shattered (drg?). Core soft due to weathering. Feo/Mno on r. to planar jts. Angular rubble (cavings?). Core hard.			
<u>Note</u> Patched, green alter. present in top 3m ±. Not readily obvious at greater depths. Red brn. pervasive oxid. Feo/Mno on defects. Substantially weakens core								Finely jtd. / fract. Weak. Intensely fragmented/disturbed. Clay content suggests a shear present. HW. Loss prob. in shear and/or drg.			
								V. cl. jtd. - along core axis Jts rough. Feo/Mno chgs.			
								Finely jtd. - variable atts. Some tend polished. Feo/Mno chgs. V. weak			
								Crush end of run. Prob. due to drg.			
								Finely jtd. - tend rough Feo/Mno chgs. V. weak.			
								Thin shear indicated - f. ang. frags. Dip ca. 70°.			
								V. cl. sp. jts, mostly subll to core. Mno/Feo chgs. V. weak.			
								Crushed end run (drg?). Angular "rubble".			
								Irreg., rough/planar jts. Core sl. weak due to weathering.			
								at low L to core. Shear. Thin. Steep. Fine crush w. clay chgs. on walls. Splinters. Some polished surfaces. Core weak.			
								Steep, rough jts. Feo/Mno chgs. Ir. cl. crush on V. steep jt.			
								R. jts (v. cl. spaced) subll to core. Mno/Feo chgs. Prob. to crush. Core weak.			
								Thin shear prob. subll to bdy. Crush, w. clay chgs on walls. Polished surfaces.			
								Mid. jtd. / incip. sheared at low L to core axis. Mno/Feo chgs. V. weak. easily fragmented.			

DRILLER: H. WEBSTER STARTED: 26/6/10 FINISHED: 2/7/10 DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) Spacing of natural fractures Fractures/m of core	LOGGED: R.T./M.K. DATE: TRACED: CHECKED: ORIGINAL VERTICAL: SCALE: 1:25 SHEET: 1 OF 5 DRG NO:	PROJECT: KCDC HOLE NO: LM-2 LENGTH: 34.37m CORE BOXES: 13
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Damwatch Services

HOLE NO.

LM 2

LOG OF DRILL HOLE

PROJECT KC OC FEATURE DAM FOOTPRINT LOCATION LOWER MAUNGAKOTUKUJI
 GRID REF. T.B.C CO-ORD. T.B.C DATUM T.B.C
 ANGLE FROM HORIZONTAL 70° DIRECTION 149° H.A.D. GROUND T.B.C H.A.D. COLLAR T.B.C

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	Piezometers LIFT % 50 100	CORE RECOVERY H.A.D. Core size, casing m 50 100	LOG GRAPHIC	FRACTURE LOG (Spacing of natural fractures) 50 100 cms 1 2 10 20 100 1000	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.O.D. % Date	WATER LEVEL % 0-100	DRILL WATER LOSS % 0-100	WATER PRESSURE TESTS - Lugeons or PERMEABILITY-10 ⁻⁶ cm/s 5 10 100 1000
Box 3 Box 4 Box 5 Box 6 Diminished oxid^d but whole of core st. discoloured (brn/grn) and FeO present on defects. Some consequential loss of core strength.							Incip. fracturing / minor jts.	0.53			
							Thin crush on low L	0.71			7.90
							Core disturbed. V. cl. sp. r. jts w. crush dtgs and polished surfs. FeO/MnO.	0.15			
							Crush dtgs. FeO/MnO on variable jts. Weak.	0.32			
							Rough, anastomosing jts @ low Ls. to core. Crush films, MnO/FeO dtgs. Core generally weak.	0.39			
							Prob. shear. Some clay present in debris. Disturbed. Minor. V. cl. sp. r. jts. / incip. jts. FeO/MnO dtgs. Weak.	0.41			
							Loss poss. in shear, higher in run.	0.43			
							V. closely bkn, prob. by dtg. Variable, r. jts. FeO dtg. Incip. crushed.	0.44			
							Core grinding.	0.45			
							Finely shatter dtg - induced?	0.46			
							R. jts @ variable Ls to core	0.47			
							R. jts. variable jts. F. crush. Jts. (r.) subf to core.	0.48			
							Anastomosing, r. jts. w. tr. crush	0.49			
							Prob. as above. F. bkn. Incip. / pers. r. jts.	0.50			
							Almost sound core. incip. frags.	0.51			
						V. cl. bkn. Weak - bkn in fingers. Crush/FeO dtgs.	0.52				
						"Crush". Prob. extr. finely fractured. Weak.	0.53				
						V. friable frag. at both run	0.54				
						Loss prob. in V. soft, friable gulle.	0.55				
						Hard rk. frags. w/ sh. R. jts.	0.56				
						Loss prob. in finely fractured core. No defined shear. V. weak?	0.57				
						V. cl. sp. r. jts.	0.58				

DRILLER: H. WERSTEN
 STARTED: 26/6/10
 FINISHED: 2/7/10
 DRILL:

ROCK WEATHERING
 UW - Unweathered
 SW - Slightly weathered
 MW - Moderately weathered
 HW - Highly weathered
 CW - Completely weathered

EXPLANATION

ROCK HARDNESS
 VH - Very hard
 H - Hard
 MH - Moderately hard
 MS - Moderately soft
 S - Soft
 VS - Very soft

FRACTURE LOG
 (cms)
 Spacing of natural fractures
 Fractures/m of core

LOGGED: P.T./M.V.
 DATE: 2/7/10
 TRACED: 2/7/10
 CHECKED: 2/7/10
 ORIGINAL VERTICAL: 1:25
 SCALE: 1:25

PROJECT: KC OC
 HOLE NO: LM-2
 LENGTH: 34.37
 CORE BOXES: 13

Damwatch Services

HOLE NO.

LM 2

LOG OF DRILL HOLE

PROJECT KCDC FEATURE DAM FOOTPRINT LOCATION LOWER MAUNGAKO TUKUTUKU
 GRID REF. T.B.C CO-ORD. T.B.C DATUM T.B.C
 ANGLE FROM HORIZONTAL 70° DIRECTION 149° H.A.D. GROUND T.B.C H.A.D. COLLAR T.B.C

DESCRIPTION OF CORE	ROCK WEATHERING	ROCK HARDNESS	Piezometers	CORE RECOVERY	DEPTH H.A.D.	LOG	FRACTURE LOG	ROCK DEFECTS	DATE/DEPTH	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE
WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	SW MW HW	MS S VS	50 50	LIFT %	Core size casing	GRAPHIC LOG	(Spacing of natural fractures) 50 10 5 1 cms	PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)			0-100	TESTS - Lugeons or PERMEABILITY-10 ⁶ cm/s
										Date		

Box 6

Box 7

Box 8

Box 9

No defined bedding.
Fabric previously sheared & reheated

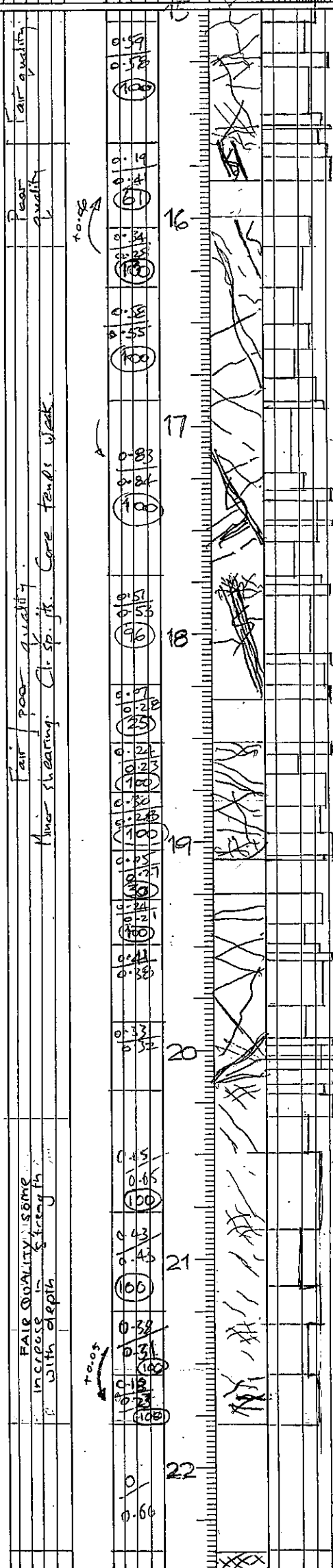
Minor green alteration

Some FeO on & marginal to defects.
Some influence on core strength

High quartz content.
Much of it may be secondary

Pelitic (original)

High qtz. content.



Rough, variable, cl./v.cl. spaced joints / incip. jts.
Minor fines as coatings.

Shear. Dist. by clay, but fine, weak frags. w. some clay and polished surfaces.

Healed footwall. Dip 85°.

Irreg., rough jts / incip. jts.
Core sl. weakened by weathering

Note: Old, healed shearing sub// to core length

Shear. Thin crush. Some polishing. Dip ca. 60°.
Cl. sp. r. jts.

Rubble.
Finely shattered - dry-induced?
Old shear (largely healed) w. minor reactivation - thin crush.
Dip ca. 80°.
Finely fragmented.

R. jts.
Cl./v.cl. sp. r. jts. / incip. jts.

Disturbed. V.cl. jts.
No shearing evident.

Cl./v.cl. r. / planar jts. Minor crush frags.
Core weak.

V.cl. sp. r. jts. w. minor crush - disturbed in part. Weak

Cl - V. cl. spaced rough jts. w. some clay coating on joint surface.

Core loss.

Rock recovered as large gravel sized frags.

DRILLER: <u>H. WEBSTER</u> STARTED: <u>26/6/10</u> FINISHED: <u>2/7/10</u> DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) Spacing of natural fractures Fractures/m of core	LOGGED: <u>R.T./M.K.</u> DATE: TRACED: CHECKED: ORIGINAL VERTICAL: SCALE: <u>1:25</u>	PROJECT: <u>KCDC</u> HOLE NO: <u>LM-2</u> LENGTH: <u>34.37</u> CORE BOXES: <u>13</u>
SHEET <u>3</u> OF <u>5</u>				DRG NO	

Damwatch Services

HOLE NO. **LM-2**

PROJECT **KCOL** FEATURE **DAM FOOTPRINT** LOCATION **LOWER MAUNGA KOTOKU TO KUI**

GRID REF. CO-ORD. DATUM

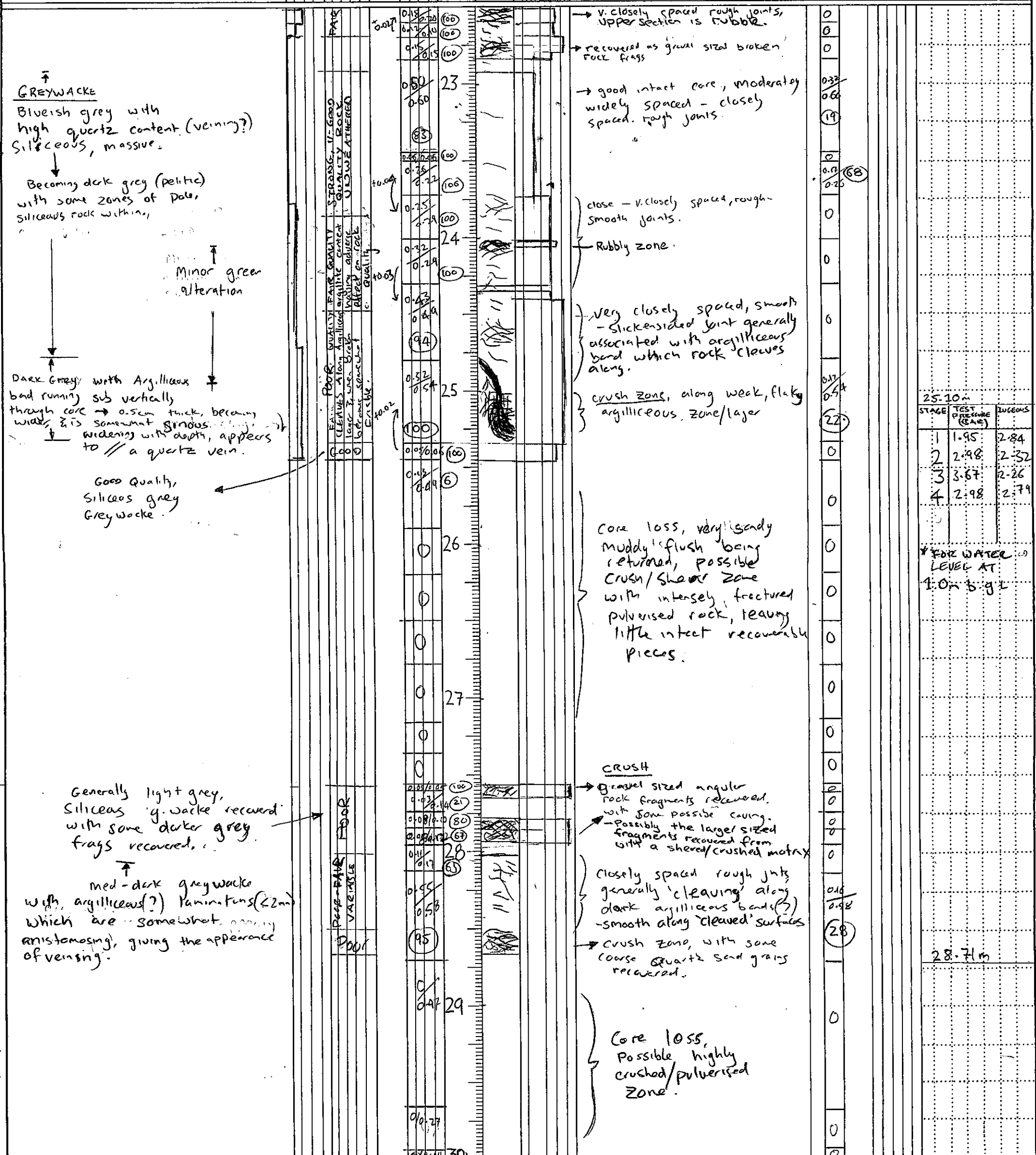
ANGLE FROM HORIZONTAL **70°** DIRECTION **149°** H.A.D. GROUND H.A.D. COLLAR

DESCRIPTION OF CORE	ROCK WEATHERING	ROCK HARDNESS	Piezometers	CORE RECOVER	DEPTH H.A.D.	LOG	FRACTURE LOG	ROCK DEFECTS	DATE/DEPTH	R.Q.D. %	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE
WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	UH - Unweathered SW - Slightly weathered MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft		LIFT %	Core size, casing	GRAPHIC	(Spacing of natural fractures) 50 10 5 1 cm	PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)					TESTS - Lugeons or PERMEABILITY - 10 ⁻⁸ cm/s

Box 9

Box 10

Box 11



DRILLER: H. WEBSTER STARTED: 26/6/10 FINISHED: 2/7/10 DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered EXPLANATION	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cm) Spacing of natural fractures Fractures/m of core 1 100 50 10 5 1 2 10 20 100 1000	LOGGED: R.T/M.K. DATE: TRACED: CHECKED: ORIGINAL VERTICAL: SCALE: 1:25 SHEET 4 OF 5	PROJECT: KCOL HOLE NO: LM-2 LENGTH: 34.37 CORE BOXES: 13 DRG NO
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Damwatch Services

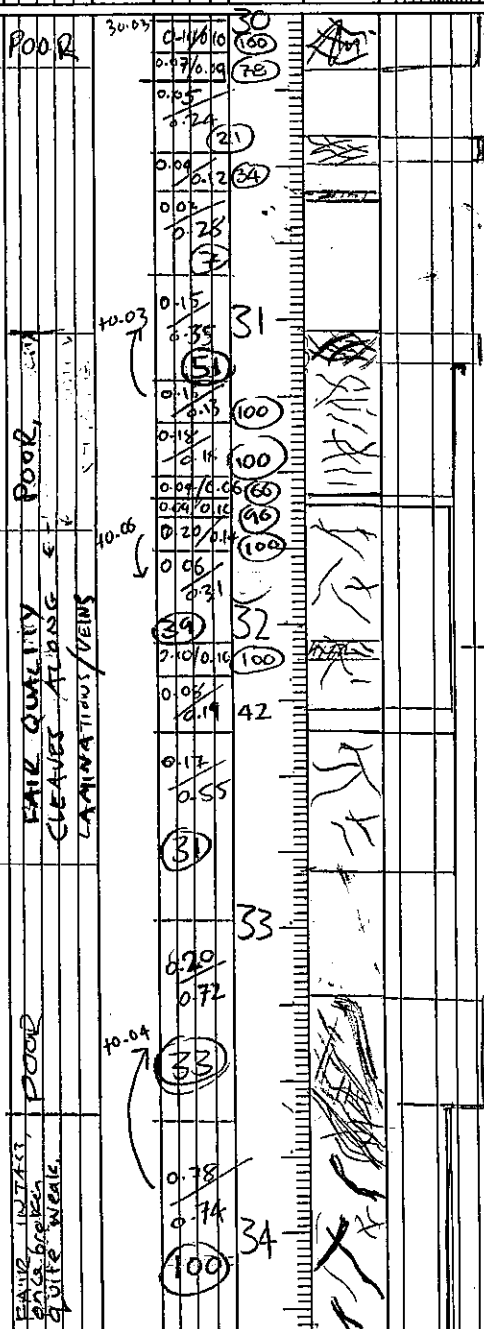
HOLE NO. **LM-2**

PROJECT **KCDC** FEATURE **DAM FOOTPRINT** LOCATION **LOWEN MAUNGA KOTUKUTOKU**
 GRID REF. **T.B.C** CO-ORD. **T.B.C** DATUM **T.B.C**
 ANGLE FROM HORIZONTAL **70°** DIRECTION **149°** H.A.D. GROUND **T.B.C** H.A.D. COLLAR **T.B.C**

DESCRIPTION OF CORE	ROCK WEATHERING	ROCK HARDNESS	Piezometers	CORE RECOVER	DEPTH H.A.D.	LOG	FRACTURE LOG	ROCK DEFECTS	DATE/DEPTH	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE
WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	SW MW HW	MS S		LIFT %	Core size, casing m	GRAPHIC	(Spacing of natural fractures) 60 30 15 10 5 1	PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	R.Q.D. %		0-100	TESTS - Lugeons or PERMEABILITY-10 ⁻⁸ m/s
									Date			

DARK G.WACKE WITH QUARTZ VEINING.
 DARK ARGILLICEOUS LAMINATIONS WITHIN (2.5m), generally sub vert, but have characteristics of veining with varying orientations, anastomosing.

GREY, SILICEOUS, with Abundant quartz veining, Some dark grey patches within, becoming pelitic with depth.



LOGGED: **R.T./M.I.C** PROJECT: **KCDC**
 DATE: HOLE NO: **LM-2**
 TRACED: LENGTH:
 CHECKED: CORE BOXES: **13**
 ORIGINAL VERTICAL:
 SCALE: **1:25**
 SHEET **5** OF **5** DRG NO

DRILLER: **H. WEBSTER**
 STARTED: **26/6/10**
 FINISHED: **2/7/10**
 DRILL:

ROCK WEATHERING
 UW - Unweathered
 SW - Slightly weathered
 MW - Moderately weathered
 HW - Highly weathered
 CW - Completely weathered

ROCK HARDNESS
 VH - Very hard
 H - Hard
 MH - Moderately hard
 MS - Moderately soft
 S - Soft
 VS - Very soft

EXPLANATION

FRACTURE LOG
 (cms)
 100 50 10 5 1
 Spacing of natural fractures
 Fractures/m of core

LM 3

ANGLE FROM HORIZONTAL -45° DIRECTION 330° H.A.D. GROUND - H.A.D. COLLAR -

DRILLER: WEBSTER	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) 	LOGGED: RT/MK. DATE: June '10 TRACED: CHECKED: ORIGINAL VERTICAL: SCALE:	PROJECT: Lower Maung HOLE NO: LM 3 LENGTH: 54.03 CORE BOXES: 19
STARTED: FINISHED: 22/6/10 DRILL:	EXPLANATION				
SHEET 1 OF 8 DRG NO					

Damwatch Services

HOLE NO.

LM 3

LOG OF DRILL HOLE

PROJECT KCD FEATURE DAM FOOTPRINT LOCATION LOWER MAINGAKO TUKUTUKU

GRID REF. T.B.C CO-ORD. T.B.C DATUM T.B.C

ANGLE FROM HORIZONTAL 45° DIRECTION 330° H.A.D. GROUND - H.A.D. COLLAR -

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING		ROCK HARDNESS		Piezometers	CORE RECOVER LIFT %	DEPTH H.A.D. Core size, casing m	LOG GRAPHIC LOG	FRACTURE LOG (Spacing of natural fractures) 50 10 5 1 cms	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.Q.D. % Date	WATER LEVEL WATER LOSS %	DRILL WATER LOSS %	WATER PRESSURE TESTS - Lugeons or PERMEABILITY-10 ⁶ cm/s
	SW MW HW	HH MH MS S	HH MH MS S	HH MH MS S										
Gravel cobbles to 16 cm core length Subred. gravel cobbles and grav. clasts. Gravel clasts. Ang. - subred. Gravel/cobble clasts. Subred. Top of gravel in run at 9.40 Ca. 9.40 - T.D. <u>Graywacke</u> Sandstone w. v. minor argillite Gravel black Periwinkle oxid. Dk brown. Dk. green alteration Some qtz. veining. Tend sub-ll to bedding Green alt. sub-ll to bdg. Patched oxid. Tr. along shear Trace FeO on jts Gravel dk. grey to black. Irreg. qtz. veining. Bedding Contorted Vague Prob. bdy Gray-green alteration Alteration Colour dk. grey to black. Hard to determine bedding										No recovered core. Fine, ang. frags. No crush matls. 20 Pass. bdy Closely bkn. along variable joints. Tend rough. Minor polishing. 30 Shear Finely fragmented Weak. Some slick'd. surfaces. Minor. 20 Variable, r. jts. Slight polishing. 20 Soft clay/minerals coat frags. Shear: Finely fragmented. Weak. Green mineral coats frags. Prob. sub-ll to bdg. Fine, ang. frags. No crush. H. wall gauge. 45 Shear Clay seam to 2 cm. - v. soft. Fault Finely fragmented to soft crush. (Prob. sub-ll to bdg.) Several cms. v. soft "clay" on fault wall. Shattered core. Shear V. weak, f. fragmented. W. trace fines. Warped thin crushes. Attitude uncertain. V. cl. sp. rough/planner jts. w. "Rubble" traces crush. SPD. Surfs. Sheared V. cl. sp., irreg. jts. w. minor polishing & some crush on surfaces. Weak. Rubble core. V. cl. sp. jts. Healed frags. in intact core. V. cl. sp. jts. w. some crush atgs. Defect atts. variable. Weak.				

DRILLER: <u>WEBSTERS</u> STARTED: FINISHED: <u>22/6/10</u> DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) Spacing of natural fractures Fractures/m of core	LOGGED: <u>R.T/M.E</u> DATE: TRACED: CHECKED: ORIGINAL VERTICAL: SCALE:	PROJECT: <u>KCD</u> HOLE NO: <u>LM-3</u> LENGTH: <u>54.03</u> CORE BOXES: <u>19</u>
SHEET <u>2</u> OF <u>8</u>				DRG NO	

HOLE NO.	LM 3
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PROJECT KCDC FEATURE DAM FOOTPRINT LOCATION LOWER MAUNGA KOTUKUTUKU

GRID REF. CO-ORD. DATUM

ANGLE FROM HORIZONTAL 45° DIRECTION 330° H.A.D. GROUND - H.A.D. COLLAR -

DESCRIPTION OF CORE	DIP	DIRECTION	S	RS	CORE DEPTH	G	FRACTURE	ROCK DEFECTS		WATER	DRILL	WAT
								PROMINENT	CONTS BEDDING SEAMS VENS			

DESCRIPTION OF CORE						ROCK WEATHERING		ROCK HARDNESS		Piezometers	CORE RECOVERY	DEPTH H.A.D.	LOG	FRACTURE LOG	ROCK DEFECTS		DATE/DEPTH	WATER LEVEL	DRILL WATER LOSS %	WATER PRESSURE TESTS - Lugeons or PERMEABILITY- 10^{-8} cm/s
						SW	MW	HW	H	MH	MS	S			(Spacing of natural fractures)	(Prominent joints, bedding, seams, veins shatter, shear, and crush zones, foliation schistosity (attitude, width, spacing, smoothness))	R.Q.D. %			
WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME																(OR SOIL DESCRIPTION) (consistency, compactness, water content, density, symbol etc.)				

Dk gray/black
 Fault (minor) attitude uncertain.
 Gneiss mostly submassive/siliceous. Rare evidence of bedding.
 Bedding steep. Vague.
 Gneiss dk. gray
 Some greenish alteration.
 Bdg. 65?
 Gneiss dk. gray to black. Siliceous.

Poor quality. Highly fractured. Some shearing.
 Poor/fair quality. V. closely spaced defects.
 Poor quality. Shearing and cl. sp. discontinuities.
 Fair quality. Cl. sp. jt.

15
 16
 17
 18
 19
 20
 21
 22

Cl. sp. variable jts. Planar to rough. Weak. Minor mineral (white) ctygs.
 Shear. Intensely fractured. (Variable) w. trace crush and some polishing/slick's.
 "Rubble" - disturbed. Prob. as above.
 Shear. Intensely jtd.
 ca. 7 cm gauge.
 H. wall dip ca. 40°. Strike?
 Fault. Minor - 15 cm thick? Mostly intensely fractured crushed rock. Disturbed by drg.
 Angular rubble w. crush ctygs. on surfaces. Intense fragmentation w. thin crush seams. V. weak. Intensely shattered. incip. Shear. V. weak. Tr. crush.
 Thin crush.
 Planar to r. jts. (some polishing) w. thin incip. crushes.
 Cl. v. cl. sp. jts. (some slick'd) mostly sub-parallel to core. Planar/rough. Weak.
 Shear at end of run. Some soft crush. Att. V. weak.
 V. cl. sp. rough to planar jts. Core rubbly in part. Trace slick's on some surfaces. Weak.
 Thin, plastic (gray) clay. "Strike" unknown.
 Shear. Variably finely jointed to crushed. Discords. tend to be at low $\angle$ s to core length. V. weak.
 Strongly crushed. Finely frag. w. clay matrix.
 Intensely jtd. V. weak.
 Clay - gray, pl., soft. Intensely crushed. No att.
 Intensely fractured. V. weak.
 Thin, clayey crusher.
 Closely jtd. to incip. crushed. Firm to V. weak.
 Rubbly. V. cl. sp. jts.
 Intensely jtd. w. thin crushes. V. weak.
 Shear.
 Clay seam, prob. along bedding.
 Cl. sp.; variable jts. - rough to planar. Minor crush. Weak.

STAGE	TEST PRESSURE (BAR)	EXPOS.
1	1.64	0
2	2.67	0
3	4.40	0
4	2.67	0
5	1.64	0

15.67 m

STAGE	TEST PRESSURE (BAR)	EXPOS.
1	2.32	0
2	2.70	0
3	5.43	0
4	3.76	0
5	2.32	0

FOR WATER LEVEL AT 1.0 m b.g.l

21.08 m

DRILLER: WERTS STARTED: FINISHED: 22/6/10 DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) Spacing of natural fractures Fractures/m of core	LOGGED: R.T/m.k DATE: TRACED: CHECKED: ORIGINAL VERTICAL: SCALE:	PROJECT: KCDK HOLE NO: LM-3 LENGTH: 54.03m CORE BOXES: 19
EXPLANATION			SHEET 3 OF 8... DRG NO		

Damwatch Services

HOLE NO.

LM 3

LOG OF DRILL HOLE

PROJECT KCOC FEATURE DAM FOOTPRINT LOCATION LOWER MAUNGA KOTUKUTUKU

GRID REF. _____ CO-ORD. _____ DATUM _____

ANGLE FROM HORIZONTAL 45° DIRECTION 330° H.A.D. GROUND _____ H.A.D. COLLAR _____

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING		ROCK HARDNESS		Piezometers	CORE RECOVERY LIFT %	DEPTH H.A.D. Core size, casing m	LOG GRAPHIC LOG (Spacing of natural fractures) 50 10 5 cm	FRACTURE LOG (Spacing of natural fractures) 50 10 5 cm	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.Q.D. % Date	WATER LEVEL WATER LOSS %	DRILL WATER LOSS %	WATER PRESSURE TESTS - Lugeons or PERMEABILITY-10 ⁻⁶ cm/s 0-100 0-10 10 100 1000	
	SW MW HW	HW MS S	MS S VS	VS											
Dk. grey to black. Bedding "steep", vague.						1.50 1.50 100	23			Cl. v. cl. spaced jts. Planar to rough. Variable attitudes. Some min crush etgs. Firm to weak.	0.34 1.50 (23)				
Attenuation						1.60 1.50 100	24			Shear Intensely fractured w. some crushing. Weak V. likely sub- to bedding, but uncertain.	0.20 1.60 (13)				
Variable alteration green hues						1.60 1.50 100	25			Crush sub- to core. Crushed. V. weak. Attitude unknown.	0.23 1.60 (15)				
Dk. green alteration (Sub- to bdg?)						1.60 1.50 100	26			Shear Intensely fractured/ jts. w. crush zones. V. weak. Att. uncertain.	0.21 1.58 (13)				
Alteration Grey to pale green Prob. sub- to bdg.						1.60 1.46 100	27			Shear Intensely fractured/jts. w. thin crushes. Weak to v. weak. Attitude uncertain.	0.12 1.47 (8)				
Bdg -50°?						1.56 1.47 100	28			Irreg. jts — planar to incipient rough.					
Variable alteration (gn. / qz.)						1.56 1.47 100	29			Shear Pulverised between marginal crushes. V. weak. Attitude uncertain.					
Gulke. dk grey to black. Bedding obscure						1.56 1.47 100	30			V. cl. sp., v. irreg. frags./ jts. Weak.					
						1.56 1.47 100	31			Thin clay crushes — Warped. Flanking rk. shatter, weak.					
						1.56 1.47 100	32			"Rubble" — v. cl. sp. jts. w. thin crushes. Rough. 2 cm. clay gauge. Grey. Plastic.					
						1.56 1.47 100	33			Shear Strongly to intensely shatter. rk. w. crushes between gauges. 45-60° dip.					
						1.56 1.47 100	34			Cl. gauge					

DRILLER: <u>WEBSTERS</u>	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) Spacing of natural fractures Fractures/m of core	LOGGED: <u>R.T./M.K.</u>	PROJECT: <u>KCOC</u>
STARTED:				DATE: _____	HOLE NO: <u>LM-3</u>
FINISHED: <u>22/6/10</u>				TRACED: _____	LENGTH: <u>54.03m</u>
DRILL:				CHECKED: _____	CORE BOXES: <u>19</u>
	EXPLANATION			ORIGINAL VERTICAL: _____	
				SCALE: _____	
				SHEET <u>4</u> OF <u>8</u>	DRG NO. _____

Damwatch Services

HOLE NO.

LM 3

LOG OF DRILL HOLE

PROJECT KCDL FEATURE DAM FOOTPRINT LOCATION LOWER MAINGAKO TUKUTUKU

GRID REF. CO-ORD. DATUM

ANGLE FROM HORIZONTAL 45° DIRECTION 330° H.A.D. GROUND H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING SW - Unweathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	Piezometers	CORE RECOVER LIFT % 50 100	DEPTH H.A.D. Core size, casing m	LOG GRAPHIC LOG	FRACTURE LOG (Spacing of natural fractures) 50 100 cms Fractures/m of core	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.Q.D. % Date	WATER LEVEL WATER LOSS % 0-100	WATER PRESSURE TESTS - Lugeons or PERMEABILITY-10 ⁻⁶ cm/s 0 1 10 100 1000
Box 10 Beg.? -45° ↑ Graywacke black ↓				1.22 1.24 1.25 1.26 1.27 1.28 1.29 1.30 1.31 1.32 1.33 1.34 1.35 1.36 1.37 1.38 1.39 1.40 1.41 1.42 1.43 1.44 1.45 1.46 1.47 1.48 1.49 1.50 1.51 1.52 1.53 1.54 1.55 1.56 1.57 1.58 1.59 1.60 1.61 1.62 1.63 1.64 1.65 1.66 1.67 1.68 1.69 1.70 1.71 1.72 1.73 1.74 1.75 1.76 1.77 1.78 1.79 1.80 1.81 1.82 1.83 1.84 1.85 1.86 1.87 1.88 1.89 1.90 1.91 1.92 1.93 1.94 1.95 1.96 1.97 1.98 1.99 2.00 2.01 2.02 2.03 2.04 2.05 2.06 2.07 2.08 2.09 2.10 2.11 2.12 2.13 2.14 2.15 2.16 2.17 2.18 2.19 2.20 2.21 2.22 2.23 2.24 2.25 2.26 2.27 2.28 2.29 2.30 2.31 2.32 2.33 2.34 2.35 2.36 2.37 2.38 2.39 2.40 2.41 2.42 2.43 2.44 2.45 2.46 2.47 2.48 2.49 2.50 2.51 2.52 2.53 2.54 2.55 2.56 2.57 2.58 2.59 2.60 2.61 2.62 2.63 2.64 2.65 2.66 2.67 2.68 2.69 2.70 2.71 2.72 2.73 2.74 2.75 2.76 2.77 2.78 2.79 2.80 2.81 2.82 2.83 2.84 2.85 2.86 2.87 2.88 2.89 2.90 2.91 2.92 2.93 2.94 2.95 2.96 2.97 2.98 2.99 3.00 3.01 3.02 3.03 3.04 3.05 3.06 3.07 3.08 3.09 3.10 3.11 3.12 3.13 3.14 3.15 3.16 3.17 3.18 3.19 3.20 3.21 3.22 3.23 3.24 3.25 3.26 3.27 3.28 3.29 3.30 3.31 3.32 3.33 3.34 3.35 3.36 3.37 3.38 3.39 3.40 3.41 3.42 3.43 3.44 3.45 3.46 3.47 3.48 3.49 3.50 3.51 3.52 3.53 3.54 3.55 3.56 3.57 3.58 3.59 3.60 3.61 3.62 3.63 3.64 3.65 3.66 3.67 3.68 3.69 3.70 3.71 3.72 3.73 3.74 3.75 3.76 3.77 3.78 3.79 3.80 3.81 3.82 3.83 3.84 3.85 3.86 3.87 3.88 3.89 3.90 3.91 3.92 3.93 3.94 3.95 3.96 3.97 3.98 3.99 4.00 4.01 4.02 4.03 4.04 4.05 4.06 4.07 4.08 4.09 4.10 4.11 4.12 4.13 4.14 4.15 4.16 4.17 4.18 4.19 4.20 4.21 4.22 4.23 4.24 4.25 4.26 4.27 4.28 4.29 4.30 4.31 4.32 4.33 4.34 4.35 4.36 4.37 4.38 4.39 4.40 4.41 4.42 4.43 4.44 4.45 4.46 4.47 4.48 4.49 4.50 4.51 4.52 4.53 4.54 4.55 4.56 4.57 4.58 4.59 4.60 4.61 4.62 4.63 4.64 4.65 4.66 4.67 4.68 4.69 4.70 4.71 4.72 4.73 4.74 4.75 4.76 4.77 4.78 4.79 4.80 4.81 4.82 4.83 4.84 4.85 4.86 4.87 4.88 4.89 4.90 4.91 4.92 4.93 4.94 4.95 4.96 4.97 4.98 4.99 5.00 5.01 5.02 5.03 5.04 5.05 5.06 5.07 5.08 5.09 5.10 5.11 5.12 5.13 5.14 5.15 5.16 5.17 5.18 5.19 5.20 5.21 5.22 5.23 5.24 5.25 5.26 5.27 5.28 5.29 5.30 5.31 5.32 5.33 5.34 5.35 5.36 5.37 5.38 5.39 5.40 5.41 5.42 5.43 5.44 5.45 5.46 5.47 5.48 5.49 5.50 5.51 5.52 5.53 5.54 5.55 5.56 5.57 5.58 5.59 5.60 5.61 5.62 5.63 5.64 5.65 5.66 5.67 5.68 5.69 5.70 5.71 5.72 5.73 5.74 5.75 5.76 5.77 5.78 5.79 5.80 5.81 5.82 5.83 5.84 5.85 5.86 5.87 5.88 5.89 5.90 5.91 5.92 5.93 5.94 5.95 5.96 5.97 5.98 5.99 6.00 6.01 6.02 6.03 6.04 6.05 6.06 6.07 6.08 6.09 6.10 6.11 6.12 6.13 6.14 6.15 6.16 6.17 6.18 6.19 6.20 6.21 6.22 6.23 6.24 6.25 6.26 6.27 6.28 6.29 6.30 6.31 6.32 6.33 6.34 6.35 6.36 6.37 6.38 6.39 6.40 6.41 6.42 6.43 6.44 6.45 6.46 6.47 6.48 6.49 6.50 6.51 6.52 6.53 6.54 6.55 6.56 6.57 6.58 6.59 6.60 6.61 6.62 6.63 6.64 6.65 6.66 6.67 6.68 6.69 6.70 6.71 6.72 6.73 6.74 6.75 6.76 6.77 6.78 6.79 6.80 6.81 6.82 6.83 6.84 6.85 6.86 6.87 6.88 6.89 6.90 6.91 6.92 6.93 6.94 6.95 6.96 6.97 6.98 6.99 7.00 7.01 7.02 7.03 7.04 7.05 7.06 7.07 7.08 7.09 7.10 7.11 7.12 7.13 7.14 7.15 7.16 7.17 7.18 7.19 7.20 7.21 7.22 7.23 7.24 7.25 7.26 7.27 7.28 7.29 7.30 7.31 7.32 7.33 7.34 7.35 7.36 7.37 7.38 7.39 7.40 7.41 7.42 7.43 7.44 7.45 7.46 7.47 7.48 7.49 7.50 7.51 7.52 7.53 7.54 7.55 7.56 7.57 7.58 7.59 7.60 7.61 7.62 7.63 7.64 7.65 7.66 7.67 7.68 7.69 7.70 7.71 7.72 7.73 7.74 7.75 7.76 7.77 7.78 7.79 7.80 7.81 7.82 7.83 7.84 7.85 7.86 7.87 7.88 7.89 7.90 7.91 7.92 7.93 7.94 7.95 7.96 7.97 7.98 7.99 8.00 8.01 8.02 8.03 8.04 8.05 8.06 8.07 8.08 8.09 8.10 8.11 8.12 8.13 8.14 8.15 8.16 8.17 8.18 8.19 8.20 8.21 8.22 8.23 8.24 8.25 8.26 8.27 8.28 8.29 8.30 8.31 8.32 8.33 8.34 8.35 8.36 8.37 8.38 8.39 8.40 8.41 8.42 8.43 8.44 8.45 8.46 8.47 8.48 8.49 8.50 8.51 8.52 8.53 8.54 8.55 8.56 8.57 8.58 8.59 8.60 8.61 8.62 8.63 8.64 8.65 8.66 8.67 8.68 8.69 8.70 8.71 8.72 8.73 8.74 8.75 8.76 8.77 8.78 8.79 8.80 8.81 8.82 8.83 8.84 8.85 8.86 8.87 8.88 8.89 8.90 8.91 8.92 8.93 8.94 8.95 8.96 8.97 8.98 8.99 9.00 9.01 9.02 9.03 9.04 9.05 9.06 9.07 9.08 9.09 9.10 9.11 9.12 9.13 9.14 9.15 9.16 9.17 9.18 9.19 9.20 9.21 9.22 9.23 9.24 9.25 9.26 9.27 9.28 9.29 9.30 9.31 9.32 9.33 9.34 9.35 9.36 9.37 9.38 9.39 9.40 9.41 9.42 9.43 9.44 9.45 9.46 9.47 9.48 9.49 9.50 9.51 9.52 9.53 9.54 9.55 9.56 9.57 9.58 9.59 9.60 9.61 9.62 9.63 9.64 9.65 9.66 9.67 9.68 9.69 9.70 9.71 9.72 9.73 9.74 9.75 9.76 9.77 9.78 9.79 9.80 9.81 9.82 9.83 9.84 9.85 9.86 9.87 9.88 9.89 9.90 9.91 9.92 9.93 9.94 9.95 9.96 9.97 9.98 9.99 10.00 10.01 10.02 10.03 10.04 10.05 10.06 10.07 10.08 10.09 10.10 10.11 10.12 10.13 10.14 10.15 10.16 10.17 10.18 10.19 10.20 10.21 10.22 10.23 10.24 10.25 10.26 10.27 10.28 10.29 10.30 10.31 10.32 10.33 10.34 10.35 10.36 10.37 10.38 10.39 10.40 10.41 10.42 10.43 10.44 10.45 10.46 10.47 10.48 10.49 10.50 10.51 10.52 10.53 10.54 10.55 10.56 10.57 10.58 10.59 10.60 10.61 10.62 10.63 10.64 10.65 10.66 10.67 10.68 10.69 10.70 10.71 10.72 10.73 10.74 10.75 10.76 10.77 10.78 10.79 10.80 10.81 10.82 10.83 10.84 10.85 10.86 10.87 10.88 10.89 10.90 10.91 10.92 10.93 10.94 10.95 10.96 10.97 10.98 10.99 11.00 11.01 11.02 11.03 11.04 11.05 11.06 11.07 11.08 11.09 11.10 11.11 11.12 11.13 11.14 11.15 11.16 11.17 11.18 11.19 11.20 11.21 11.22 11.23 11.24 11.25 11.26 11.27 11.28 11.29 11.30 11.31 11.32 11.33 11.34 11.35 11.36 11.37 11.38 11.39 11.40 11.41 11.42 11.43 11.44 11.45 11.46 11.47 11.48 11.49 11.50 11.51 11.52 11.53 11.54 11.55 11.56 11.57 11.58 11.59 11.60 11.61 11.62 11.63 11.64 11.65 11.66 11.67 11.68 11.69 11.70 11.71 11.72 11.73 11.74 11.75 11.76 11.77 11.78 11.79 11.80 11.81 11.82 11.83 11.84 11.85 11.86 11.87 11.88 11.89 11.90 11.91 11.92 11.93 11.94 11.95 11.96 11.97 11.98 11.99 12.00 12.01 12.02 12.03 12.04 12.05 12.06 12.07 12.08 12.09 12.10 12.11 12.12 12.13 12.14 12.15 12.16 12.17 12.18 12.19 12.20 12.21 12.22 12.23 12.24 12.25 12.26 12.27 12.28 12.29 12.30 12.31 12.32 12.33 12.34 12.35 12.36 12.37 12.38 12.39 12.40 12.41 12.42 12.43 12.44 12.45 12.46 12.47 12.48 12.49 12.50 12.51 12.52 12.53 12.54 12.55 12.56 12.57 12.58 12.59 12.60 12.61 12.62 12.63 12.64 12.65 12.66 12.67 12.68 12.69 12.70 12.71 12.72 12.73 12.74 12.75 12.76 12.77 12.78 12.79 12.80 12.81 12.82 12.83 12.84 12.85 12.86 12.87 12.88 12.89 12.90 12.91 12.92 12.93 12.94 12.95 12.96 12.97 12.98 12.99 13.00 13.01 13.02 13.03 13.04 13.05 13.06 13.07 13.08 13.09 13.10 13.11 13.12 13.13 13.14 13.15 13.16 13.17 13.18 13.19 13.20 13.21 13.22 13.23 13.24 13.25 13.26 13.27 13.28 13.29 13.30 13.31 13.32 13.33 13.34 13.35 13.36 13.37 13.38 13.39 13.40 13.41 13.42 13.43 13.44 13.45 13.46 13.47 13.48 13.49 13.50 13.51 13.52 13.53 13.54 13.55 13.56 13.57 13.58 13.59 13.60 13.61 13.62 13.63 13.64 13.65 13.66 13.67 13.68 13.69 13.70 13.71 13.72 13.73 13.74 13.75 13.76 13.77 13.78 13.79 13.80 13.81 13.82 13.83 13.84 13.85 13.86 13.87 13.88 13.89 13.90 13.91 13.92 13.93 13.94 13.95 13.96 13.97 13.98 13.99 14.00 14.01 14.02 14.03 14.04 14.05 14.06 14.07 14.08 14.09 14.10 14.11 14.12 14.13 14.14 14.15 14.16 14.17 14.18 14.19 14.20 14.21 14.22 14.23 14.24 14.25 14.26 14.27 14.28 14.29 14.30 14.31 14.32 14.33 14.34 14.35 14.36 14.37 14.38 14.39 14.40 14.41 14.42 14.43 14.44 14.45 14.46 14.47 14.48 14.49 14.50 14.51 14.52 14.53 14.54 14.55 14.56 14.57 14.58 14.59 14.60 14.61 14.62 14.63 14.64 14.65 14.66 14.67 14.68 14.69 14.70 14.71 14.72 14.73 14.74 14.75 14.76 14.77 14.78 14.79 14.80 14.81 14.82 14.83 14.84 14.85 14.86 14.87 14.88 14.89 14.90 14.91 14.92 14.93 14.94 14.95 14.96 14.97 14.98 14.99 15.00 15.01 15.02 15.03 15.04 15.05 15.06 15.07 15.08 15.09 15.10 15.11 15.12 15.13 15.14 15.15 15.16 15.17 15.18 15.19 15.20 15.21 15.22 15.23 15.24 15.25 15.26 15.27 15.28 15.29 15.30 15.31 15.32 15.33 15.34 15.35 15.36 15.37 15.38 15.39 15.40 15.41 15.42 15.43 15.44 15.45 15.46 15.47 15.48 15.49 15.50 15.51 15.52 15.53 15.54 15.55 15.56 15.57 15.58 15.59 15.60 15.61 15.62 15.63 15.64 15.65 15.66 15.67 15.68 15.69 15.70 15.71 15.72 15.73 15.74 15.75 15.76 15.77 15.78 15.79 15.80 15.81 15.82 15.83 15.84 15.85 15.86 15.87 15.88 15.89 15.90 15.91 15.92 15.93 15.94 15.95 15.96 15.97 15.98 15.99 16.00 16.01 16.02 16.03 16.04 16.05 16.06 16.07 16.08 16.09 16.10 16.11 16.12 16.13 16.14 16.15 16.16 16.17 16.18 16.19 16.20 16.21 16.22 16.23 16.24 16.25 16.26 16.27 16.28 16.29 16.30 16.31 16.32 16.33 16.34 16.35 16.36 16.37 16.38 16.39 16.40 16.41 16.42 16.43 16.44 16.45 16.46 16.47 16.48 16.49 16.50 16.51 16.52 16.53 16.54 16.55 16.56 16.57 16.58 16.59 16.60 16.61 16.62 16.63 16.64 16.65 16.66 16.67 16.68 16.69 16.70 16.71 16.72 16.73 16.74 16.75 16.76 16.77 16.78 16.79 16.80 16.81 16.82 16.83 16.84 16.85 16.86 16.87 16.88 16.89 16.90 16.91 16.92 16.93 16.94 16.95 16.96 16.97 16.98 16.99 17.00 17.01 17.02 17.03 17.04 17.05 17.06 17.07 17.08 17.09 17.10 17.11 17.12 17.13 17.14 17.15 17.16 17.17 17.18 17.19 17.20 17.21 17.22 17.23 17.24 17.25 17.26 17.27 17.28 17.29 17.30 17.31 17.32 17.33 17.34 17.35 17.36 17.37 17.38 17.39 17.40 17.41 17.42 17.43 17.44 17.45 17.46 17.47 17.48 17.49 17.50 17.51 17.52 17.53 17.54 17.55 17.56 17.57 17.58 17.59 17.60 17.61 17.62 17.63 17.64 17.65 17.66 17.67 17.68 17.69 17.70 17.71 17.72 17.73 17.74 17.75 17.76 17.77 17.78 17.79 17.80 17.81 17.82 17.83 17.84 17.85 17.86 17.87 17.88 17.89 17.90 17.91 17.92 17.93 17.94 17.95 17.96 17.97 17.98 17.99 18.00 18.01 18.02 18.03 18.04 18.05 18.06 18.07 18.08 18.09 18.10 18.11 18.12 18.13 18.14 18.15 18.16 18.17 18.18 18.19 18.20 18.21 18.22 18.23 18.24 18.25 18.26 18.27 18.28 18.29 18.30 18.31 18.32 18.33 18.34 18.35 18.36 18.37 18.38 18.39 18.40 18.41 18.42 18.43 18.44 18.45 18.46 18.47 18.48 18.49 18.50 18.51 18.52 18.53 18.54 18.55 18.56 18.57 18.58 18.59 18.60 18.61 18.62 18.63 18.64 18.65 18.66 18.67 18.68 18.69 18.70 18.71 18.72 18.73 18.74 18.							

Damwatch Services

HOLE NO.

LM 3

LOG OF DRILL HOLE

PROJECT YCDC FEATURE DAM FOOT PRINT LOCATION LOWER MAUNGAKOTUKUTUKU

GRID REF. CO-ORD. DATUM

ANGLE FROM HORIZONTAL 45° DIRECTION 330° H.A.D. GROUND H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Piezometers	CORE RECON LIFT %	DEPTH H.A.D. Core size, casing m	LOG GRAPHIC	FRACTURE LOG LOG (Spacing of natural fractures) 50 10 5 cm	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.Q.D. %	WATER LEVEL WATER LOSS %	WATER PRESSURE TESTS - Lugeons or PERMEABILITY-10 ^{cm/s} 0-100 0-1000
Green alteration											
DK grey/black											
DK grey/black.											
SST/argillite (grey/black). Latter highly dismembered. bedding "diffuse"											
"Dip" of bdy. 45 Med. grey. Siliceous											
DK. grey.											
Vague bdy "dip" 40 Med. grey.											
"Dip" 50 Argillite - black.											
Med./dk. grey. Siliceous. No argillite or obvious bedding											

DRILLER: <u>WEBSTER</u>	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) Spacing of natural fractures Fractures/m of core	LOGGED: <u>R.T.M.K</u>	PROJECT: <u>YCDC</u>
STARTED:				DATE:	HOLE NO: <u>LM-3</u>
FINISHED: <u>22/6/10</u>				TRACED:	LENGTH: <u>54.03m</u>
DRILL:				CHECKED:	CORE BOXES: <u>19</u>
				ORIGINAL VERTICAL:	
				SCALE:	
				SHEET <u>7</u> OF <u>8</u>	DRG NO.

Damwatch Services

HOLE NO.

LM 3

LOG OF DRILL HOLE

PROJECT KCC DC FEATURE DAM FOOTPRINT LOCATION LOWER MAUNGAKOTUKUTUKU

GRID REF. CO-ORD. DATUM

ANGLE FROM HORIZONTAL 45° DIRECTION 330° H.A.D. GROUND H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Piezometers	CORE RECOVERY LIFT %	DEPTH H.A.D. Core size, casing m	LOG GRAPHIC LOG	FRACTURE LOG (Spacing of natural fractures) 50 20 10 5 1 cm Fractures/m of core	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.O.D. % Date	WATER LEVEL WATER LOSS %	DRILL WATER LOSS %	WATER PRESSURE TESTS - Lugeons or PERMEABILITY-10 ⁻⁶ cm/s
Med. to dk. grey. "Siliceous" - generates brittle fractures/jts.				9.83 9.76 (100)	53			Cl. v. ch. jts. w. traces crush. Jts. variable, planar to rough. Minor polishing, coatings.	9.11 9.83 (13)			
				9.93 9.95 (100)	54			Closely bedded - rubbly Shear 1 cm grey clay gauge on h. wall. Soft. Att. uncertain (45° rel. to core) Irreg. ch. sp. jts. Planar to rough. Brittle tendency.	9.13 9.98 (13)			
								Irreg. Shear V. fine frag.				54.03 m
								TD. 54.03				

DRILLER:
WEBSTER
STARTED:
22/6/10
FINISHED:
22/6/10
DRILL:

ROCK WEATHERING
UW - Unweathered
SW - Slightly weathered
MW - Moderately weathered
HW - Highly weathered
CW - Completely weathered

ROCK HARDNESS
VH - Very hard
H - Hard
MH - Moderately hard
MS - Moderately soft
S - Soft
VS - Very soft

FRACTURE LOG
(cms)
100 50 20 10 5 1
Spacing of natural fractures
Fractures/m of core

EXPLANATION

LOGGED: 12.1/ m.k.
DATE: 22/6/10
TRACED: 12.1/ m.k.
CHECKED: 12.1/ m.k.
ORIGINAL VERTICAL: 12.1/ m.k.
SCALE: 12.1/ m.k.
SHEET 8 OF 8 DRG NO. 12.1/ m.k.

PROJECT: KCC DC
HOLE NO: LM-3
LENGTH: 54.03 m
CORE BOXES: 19

Damwatch Services

HOLE NO.

LM 4

LOG OF DRILL HOLE

PROJECT **KCOC**

FEATURE **DAM FOOTPRINT**

LOCATION **LOWER MAUNGAKOTUKUTUKU**

GRID REF. **T.B.C**

CO-ORD. **T.B.C**

DATUM **T.B.C**

ANGLE FROM HORIZONTAL **90°**

DIRECTION **-**

H.A.D. GROUND **T.B.C**

H.A.D. COLLAR **T.B.C**

DESCRIPTION OF CORE

WEATHERING, HARDNESS, STRENGTH, COLOUR,
ROCK OR SOIL TYPE, DEFECT SPACING,
LITHOLOGICAL FEATURES (bedding, foliation, mineralogy,
texture, cement, etc); STRATIGRAPHIC NAME

ROCK WEATHERING
SW
MW
HW

ROCK HARDNESS
H
MH
MS
S

Piezometers
50
100

CORE RECOVERY
LIFT
%
50
100

DEPTH
H.A.D.
Core size,
casing
m

LOG
GRAPHIC
LOG
50
100
cm
m

FRACTURE
LOG
(Spacing of
natural
fractures)
50
100
cm
m

ROCK DEFECTS

PROMINENT JOINTS, BEDDING, SEAMS, VEINS
SHATTER, SHEAR, AND CRUSH ZONES, FOL-
IATION SCHISTOSITY (attitude, width, spacing,
smoothness)
(OR SOIL DESCRIPTION)
(consistency, compactness, water content,
group symbol etc.)

DATE/DEPTH
R.O.D. %
Date

WATER
LEVEL
LOSS
%
0-100

DRILL
WATER
LOSS
%
0-100

WATER PRESSURE
TESTS - Lugeons
or
PERMEABILITY-10⁻⁶ cm/s
0-100

0-100

0-100

0-100

0-100

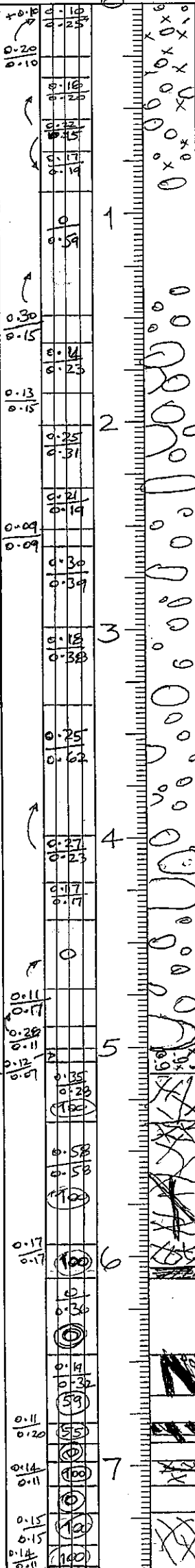
0-0.35
Soil/Alluvium mix.

0.35-5.10
River Alluvium

Indications coarse alluvium
in the complete sequence.

Expect cobbly sandy
gravel (sw). Clasts subang.
to subrounded graywacke.
SW.

Recovered material mostly
clean - likely to be dirty
in situ.



Disseminated, rounded clasts
in a clay/silt/sand
matrix. Dk. choc. brown.

Residual clay/silt/sd. matrix
in core, subrd. gravel.

Recovered clasts core,
Subrd. gravel.

Recovered clasts mostly
Subrd. cobbles.
No fines.

Recovered clasts med.
to coarse subrd.
gravel (graywacke).
No fines.

Recovered clasts w/c
gravel with one cobble.
Subrd. gwa.
Trace sandy fines.

cl. gravel w clay/silt/sd.
matrix. Dk. brown.

Disaggregated, cl./v.d. jtl.
Jts. planar/rough. Weak.

Closely jtl./incip. jtl.

Crush ctgs./infill on joints.
Generally cl. fract. weak.

V.d. sp. jts.
Shear indicated - v.f.
fragmentation w. some crush.

Shear
Rubbly frag.
Soft, gray plastic gouge.

F/Wall 45° dip. Slick'd.
(Crush splinter)

Rock shattered.

Sheared/crushed.
Angular rubble. Trace
Incip. fract. crush.

Tends rubble. V.d. sp.
Variable jts. Minor slick's.
Weak in situ.

5.10 - T.D.
Graywacke

Essentially S.T. w.
patchy argillite (diffuse)

Dk. brown
staining &
variable
pervasive
oxidⁿ

Med. blk. gray.
Siliceous.

Bedding
dip
45°

(Possible)
60°

Med/dk. gray.
Tends massive.

Minor green
alteration

DRILLER:
WE B. STEERS
STARTED:
31/5/10
FINISHED:
8/6/10
DRILL:

ROCK WEATHERING
UW - Unweathered
SW - Slightly weathered
MW - Moderately weathered
HW - Highly weathered
CW - Completely weathered

ROCK HARDNESS
VH - Very hard
H - Hard
MH - Moderately hard
MS - Moderately soft
S - Soft
VS - Very soft

FRACTURE LOG
(cms)
Spacing of
natural
fractures
Fractures/m
of core

LOGGED: **R. T.**
DATE: **31/5/10**
TRACED: **31/5/10**
CHECKED: **31/5/10**
ORIGINAL VERTICAL: **31/5/10**
SCALE: **1:100**

PROJECT: **KCOC**
HOLE NO: **LM-4**
LENGTH: **14.93 m**
CORE BOXES: **6**

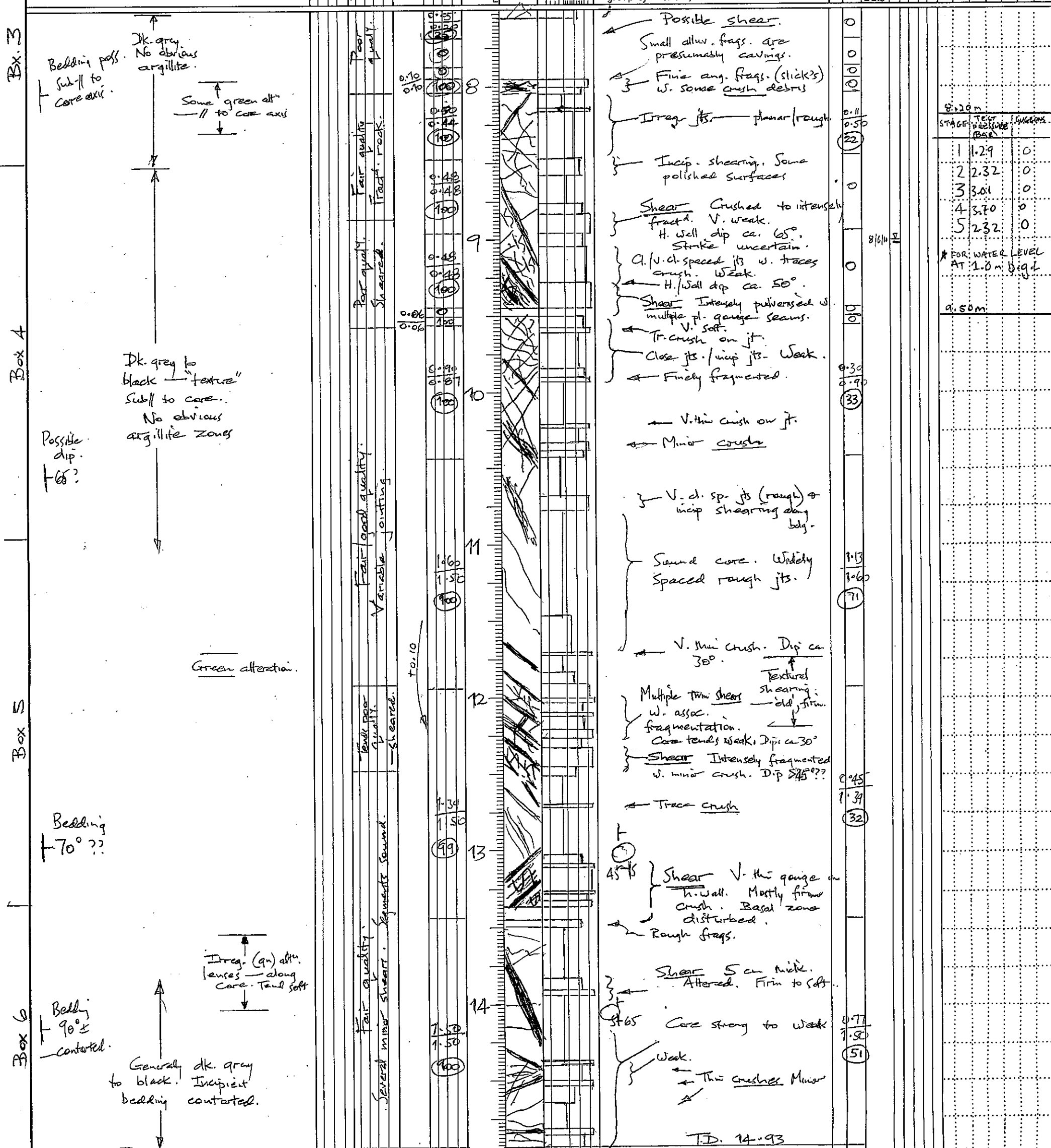
SHEET **1** OF **2** DRG NO

HOLE NO.	LM 4
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ANGLE FROM HORIZONTAL 90° DIRECTION: - H.A.D. GROUND H.A.D. COLLAR

DESCRIPTION OF CORE	ING	S	SI	CORE	DEPTH	G	FRACTURE	ROCK DEFECTS DISJUNCTION JOINTS BEDDING SEAMS VENS			WATER	DRILL	WATER
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DESCRIPTION OF CORE	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Piezometers	CORE RECOVERY	DEPTH H.A.D.	LOG	FRACTURE LOG	ROCK DEFECTS		DATE/DEPTH	WATER DRILL	WATER PRESSURE
				LIFT %	Core size, casing	(Spacing of natural fractures)	PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness)	R.O.D. %	LEVEL WATER LOSS %	TESTS - Lugeons or PERMEABILITY- 10^{-8} cm/s		
WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME				5 10 50			50 10 5 1-1		(OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	Date	0-100	01 01 1 10 100 1000



DRILLER: WEBSTER STARTED: 3/15/10 FINISHED: 8/6/10 DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) 	LOGGED: R-T DATE: TRACED: CHECKED: ORIGINAL VERTICAL: SCALE:	PROJECT: ECDC HOLE NO: LM-4 LENGTH: 14.93m CORE BOXES: 6
	EXPLANATION			SHEET 2 OF 2 DRG NO	

Damwatch Services

HOLE NO.

LM 5

LOG OF DRILL HOLE

PROJECT KCDC FEATURE DAM FOOTPRINT LOCATION LOWER MAUNGAKOTUKUKOI

GRID REF. T.B.C CO-ORD. T.B.C DATUM T.B.C

ANGLE FROM HORIZONTAL 90° DIRECTION - H.A.D. GROUND - H.A.D. COLLAR -

DESCRIPTION OF CORE	ROCK WEATHERING	ROCK HARDNESS	Piezometers	CORE RECOVERY	DEPTH	LOG	FRACTURE LOG	ROCK DEFECTS	DATE/DEPTH	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE
WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	SW MW HW	H MH MS S	50 50	LIFT %	Core size, casing	GRAPHIC LOG	(Spacing of natural fractures)	PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)			0-100	TESTS - Lugeons or PERMEABILITY-10 ⁻⁶ cm/s

0-0.20 Soil Top 5cm organic then dk. brown loess (decreasing org.)

0.20-3.15 Contact diffuse. Loess with Subordinate Colluvial detritus

Mostly yellow brown (some orange) silty clay/clayey silt. Cohesive. Compact. Soft to firm. Variable plasticity. Moist. Perhaps 10% angular, gule. clasts to crse. gravel size. Disseminated. Minor rods, upper section.

Subrounded clasts appear at this depth.

3.15-9.14 River Alluvium

Prominent matrix.

4.30-4.50 Clayey silt unit. Soft. Plastic.

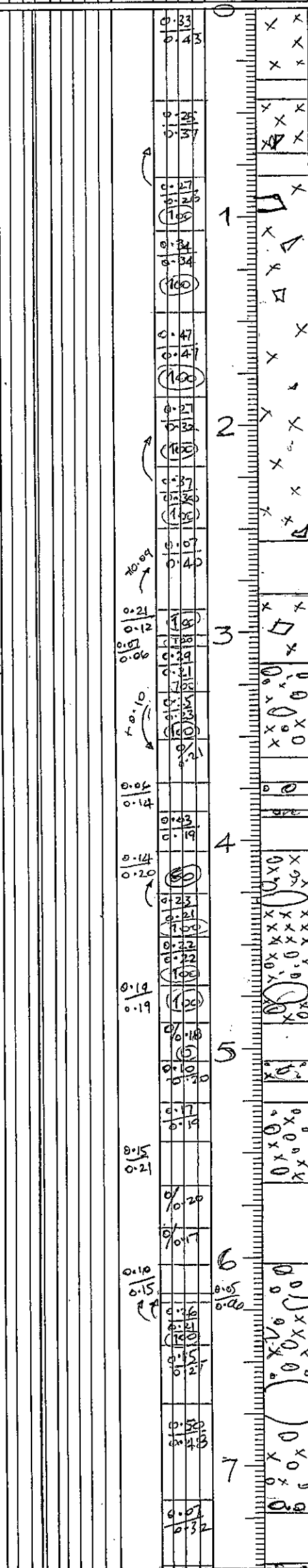
Prominent dirty matrix in rel. fine alluvium.

Washed Matrix strongly weathered (dk. orangey brown) but clasts SW/MW.

≥ 50% matrix - dirty, compact, firm.

Prob. boulder Mostly matrix Dirty. Compact Firm.

Gravel frags.



Note:

- Layered in terms of strength (eg. soft/firm) but not obvious in core.
- Core loss minimal.
- Significant post-deposition weathering. Suggests a significant but uncertain age.

Note:

- Losses small.
- Alluvium dirty - orange yell. brn. - high clay/silt content.
- Where recovered, matrix compact, firm.
- On basis of matrix, alluvium appears to be relatively old.
- Intersected cobbles and boulders rare.

DRILLER: <u>WEBSTERS</u> STARTED: <u>3/5/10</u> FINISHED: <u>8/6/10</u> DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) Spacing of natural fractures Fractures/m of core	LOGGED: <u>R.T</u> DATE: <u>3/5/10</u> TRACED: <u>3/6/10</u> CHECKED: <u>3/6/10</u> ORIGINAL VERTICAL: <u>3/6/10</u> SCALE: <u>3/6/10</u> SHEET <u>1</u> OF <u>3</u>	PROJECT: <u>KCDC</u> HOLE NO: <u>LM-5</u> LENGTH: <u>17.02</u> CORE BOXES: <u>7</u> DRG NO
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HOLE NO.	LM 5
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DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc); STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Piezometers	CORE RECOVERY LIFT %	DEPTH H.A.D. Core size, casing m	GRAPHIC LOG	FRACTURE LOG (Spacing of natural fractures) 50 10 10 50 cms	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOL- IATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc.)	DATE/DEPTH R.O.D. % Date	WATER	DRILL	WATER PRESSURE	
										LEVEL	WATER	TESTS - Lugeons or PERMEABILITY-10 ⁻⁶ cm/s	
											0-100	0-1 0-1 1 10 100 1000	

Predom. dirty matrix (cl. si. sand) }
 Cbly. grav. w. }
 dirty matrix }
 Dirty matrix recovered. →
 Recovered dirty matrix (si/sd/gravel). →
 Contact rough. →

9.14 = TD
Greywacke
 Generally dk. gray to black; no obvious argillite.
 Poss. bedding. Tends siliceous. Some vague bedding indications. Pervasive FeO on joints.
 Bedding deformed, sheared.
 50-90°
 Bdg. 70°??
 Bdg. poss sub// to core.
 Bdg. // to core??
 Patchy penetrative alteration — essentially thin, green stringers and veins. Commonly deformed, hence 'old'. No adverse influence on core strength.
 Green att? within shear system

Good Quality
 V. minor shearing. Jtg. irreg; cl. spaced.
 Poor quality. Sheared - weak.
 Good quality

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DRILLER: WEBSTERS STARTED: 3/15/16 FINISHED: 8/6/16 DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG (cms) 	LOGGED: R.T. DATE: TRACED: CHECKED: ORIGINAL VERTICAL: SCALE:	PROJECT: KCA HOLE NO: LM-5 LENGTH: 17.02 CORE BOXES: 7
	EXPLANATION				SHEET 2 OF 3 DRG NO

LM 5

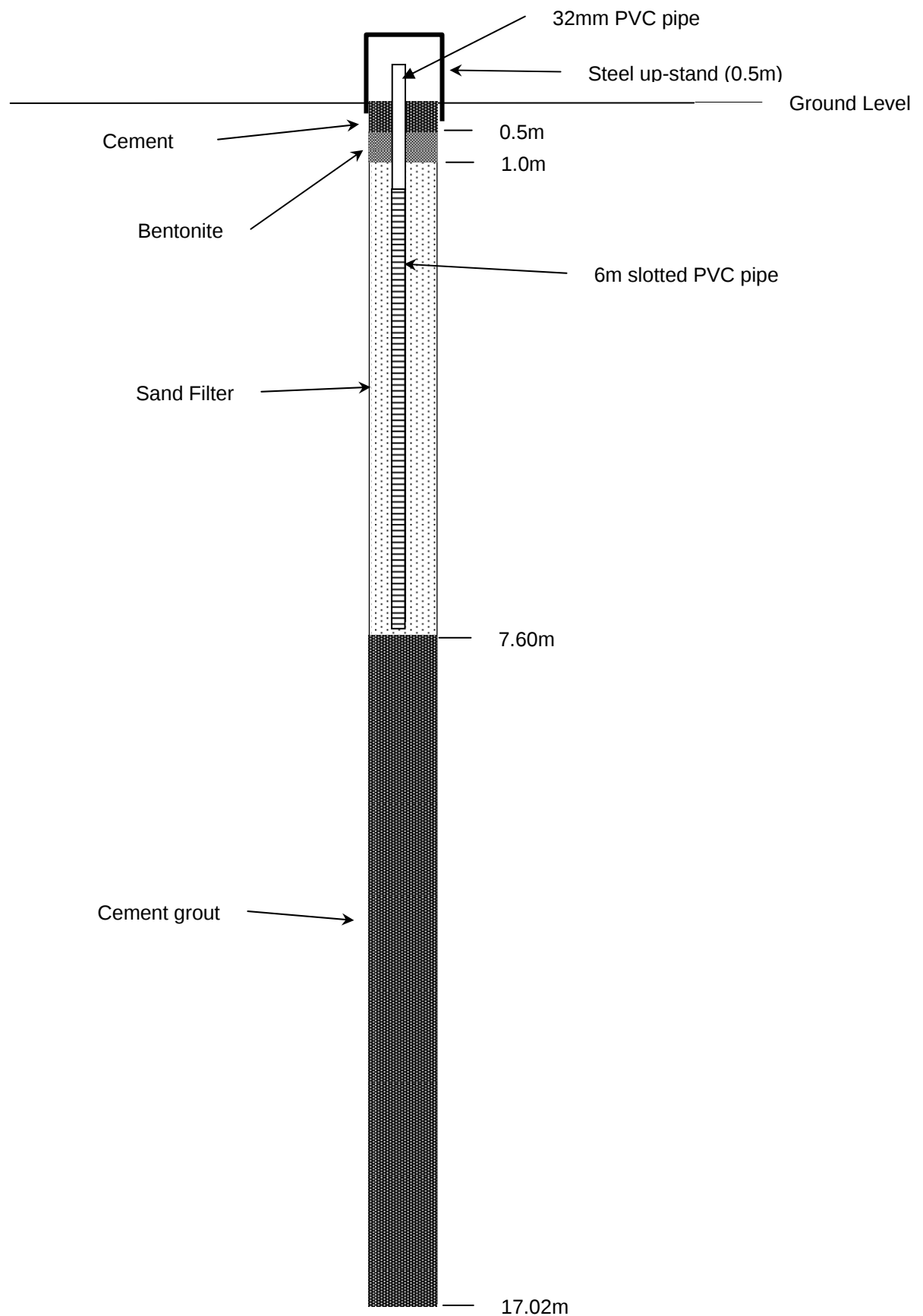
PROJECT	XC DC	FEATURE	LOW DAM FOOTPRINT	LOCATION	LOWER MAUNG AKE TU KUTU KSI
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GRID REF. CO-ORD. DATUM

ANGLE FROM HORIZONTAL 90° DIRECTION — H.A.D. GROUND H.A.D. COLLAR

DRILLER: WEKSTERS STARTED: 3/5/10 FINISHED: 8/6/11 DRILL:	ROCK WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	ROCK HARDNESS VH - Very hard H - Hard MH - Moderately hard MS - Moderately soft S - Soft VS - Very soft	FRACTURE LOG 	LOGGED: R.T. DATE: TRACED: CHECKED: ORIGINAL VERTICAL: SCALE:	PROJECT: KOC HOLE NO: LM-5 LENGTH: 17.07 CORE BOXES: 7
	EXPLANATION		SHEET 3 OF 3 DRG NO		

LM-5 Piezometer Installation Sketch



Appendix D: Drill Hole Core Photos











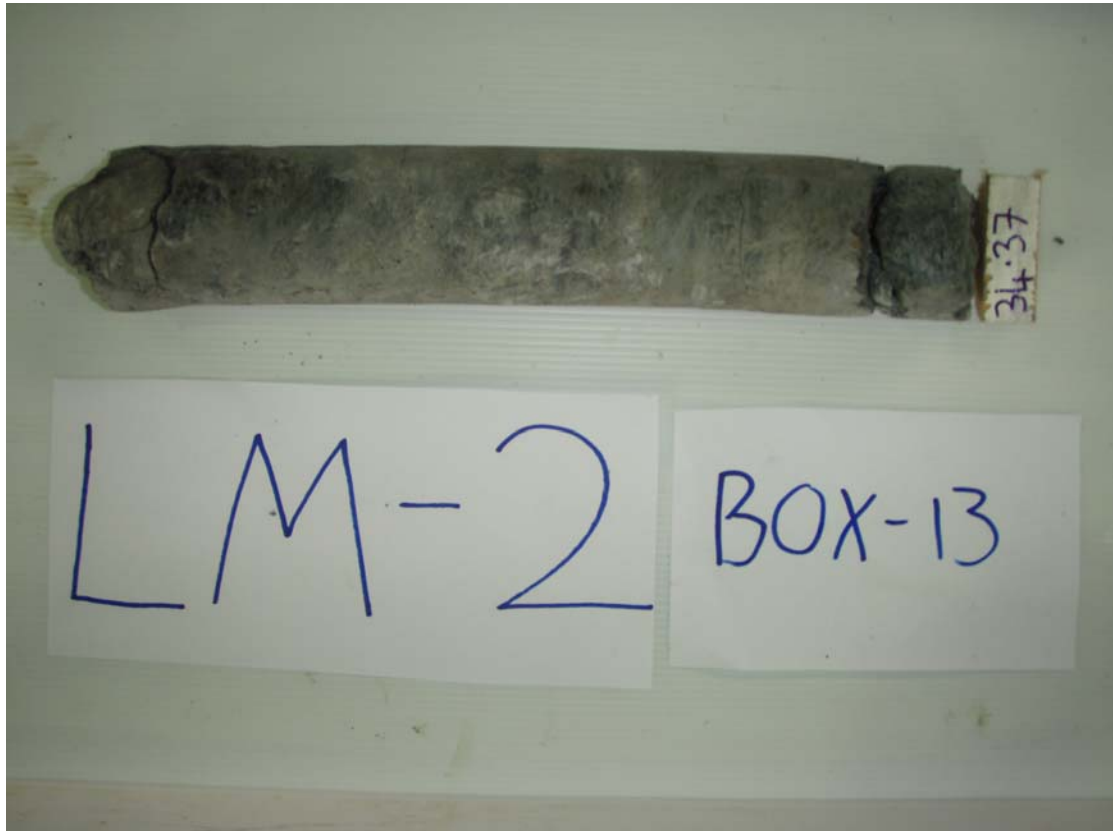














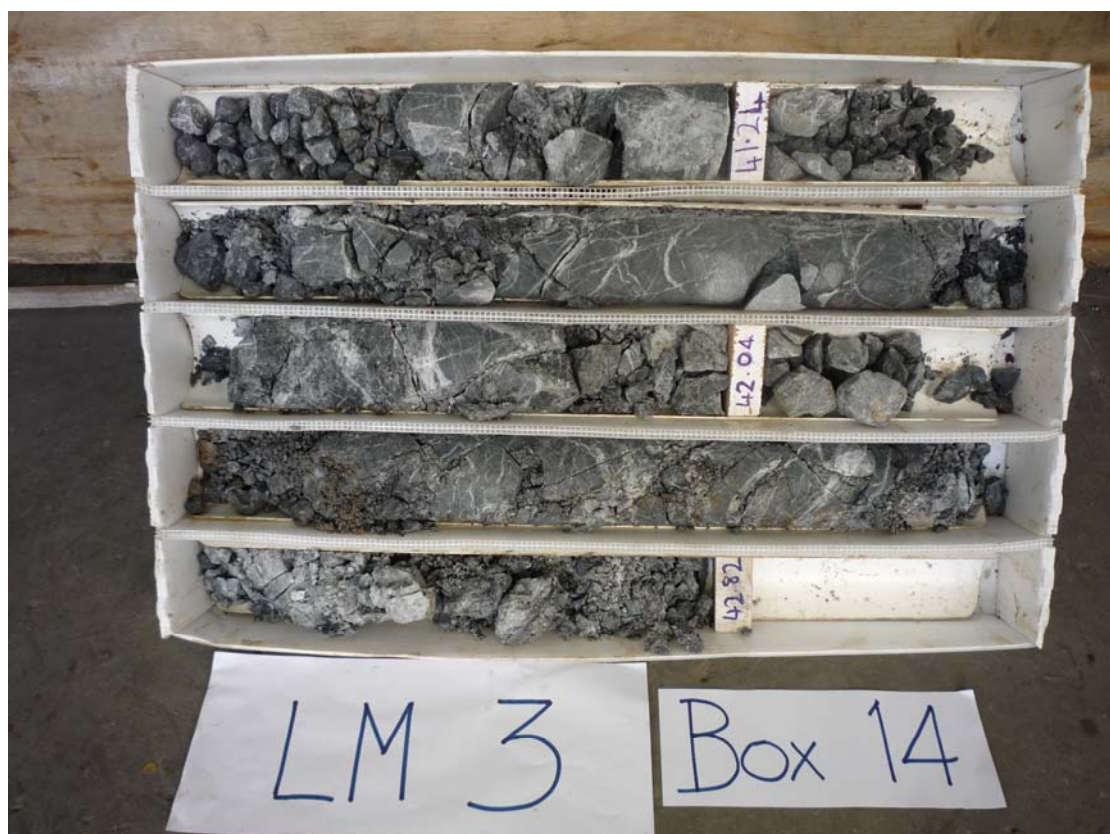
































Appendix E: Lugeon Test Results Summary

Drillhole	Test Section			Test Pressure (Bar)	Lugeon Value	Interpretation*
	From (m)	To (m)	Length (m)			
LM1	10.00	11.03	1.03	1.25	0.0	No water taken
				2.29	0.0	
				2.98	0.0	
				2.29	0.0	
				1.25	0.0	
LM1	16.70	20.00	3.30	1.25	0.0	No water taken
				2.29	0.0	
				2.98	0.0	
				2.29	0.0	
				1.25	0.0	
LM2	6.20	7.90	1.70	1.27	9.3	Lugeons increasing as test progresses (except stage 5) suggesting washout of defects. The zone tested was running sub parallel to the open river gorge walls. Due to the relaxed state of the rock mass in the gorge walls higher permeabilities were expected.
				2.30	15.3	
				2.99	25.6	
				2.30	30.6	
				1.27	27.8	
LM2	17.20	20.96	3.76	2.29	0.0	Insignificant water taken during stage 2 & 5. Essentially no flow
				3.67	0.4	
				5.05	0.0	
				3.67	0.0	
				2.29	0.6	

* Houlby A.C. Routine Interpretation of the Lugeon Water Test. *Q. Jl Engng Geol* **1976**, 9, 303-313.

Drillhole	Test Section			Test Pressure (Bar)	Lugeon Value	Interpretation*
	From (m)	To (m)	Length (m)			
LM2	25.10	28.71	3.61	1.95	2.8	Lugeons are about equal over all test pressures. Laminar flow
				2.98	2.3	
				3.67	2.3	
				2.98	2.8	
				0.00	0.0	
LM3	14.67	15.67	1.00	1.64	0.0	No water taken
				2.67	0.0	
				4.40	0.0	
				2.67	0.0	
				1.64	0.0	
LM3	17.40	21.08	3.68	2.32	0.0	No water taken
				3.70	0.0	
				5.43	0.0	
				3.70	0.0	
				2.32	0.0	
LM3	28.40	29.53	1.13	3.36	0.0	Highest lugeon occurs at highest test pressure, suggesting dilation of defects
				5.77	0.8	
				7.84	1.7	
				5.77	0.8	
				3.36	0.0	

* Houlsby A.C. Routine Interpretation of the Lugeon Water Test. *Q. Jl Engng Geol* **1976**, 9, 303-313.

Drillhole	Test Section			Test Pressure (Bar)	Lugeon Value	Interpretation*
	From (m)	To (m)	Length (m)			
LM3	36.60	38.10	1.50	2.33	0.0	Insignificant water taken only during stage 2. Essentially no flow
				4.12	0.5	
				5.43	0.0	
				4.12	0.0	
				2.33	0.0	
LM3	37.90	41.24	3.34	3.02	0.5	Lugeons increase during stage 2 and then progressively decrease through to stage 5. Suggesting void filling of defects during stages 3,4 & 5
				5.09	0.6	
				7.50	0.5	
				5.09	0.4	
				3.02	0.1	
LM3	46.50	54.03	7.53	3.70	0.4	Highest lugeons occurring at lowest pressures suggesting turbulent flow. Lugeons values remain very low.
				5.77	0.2	
				8.53	0.3	
				5.77	0.2	
				3.70	0.4	
LM4	8.20	9.50	1.30	1.29	0.0	No water taken
				2.32	0.0	
				3.01	0.0	
				3.70	0.0	
				2.32	0.0	
				1.29	0.0	

* Houlby A.C. Routine Interpretation of the Lugeon Water Test. *Q. Jl Engng Geol* **1976**, 9, 303-313.

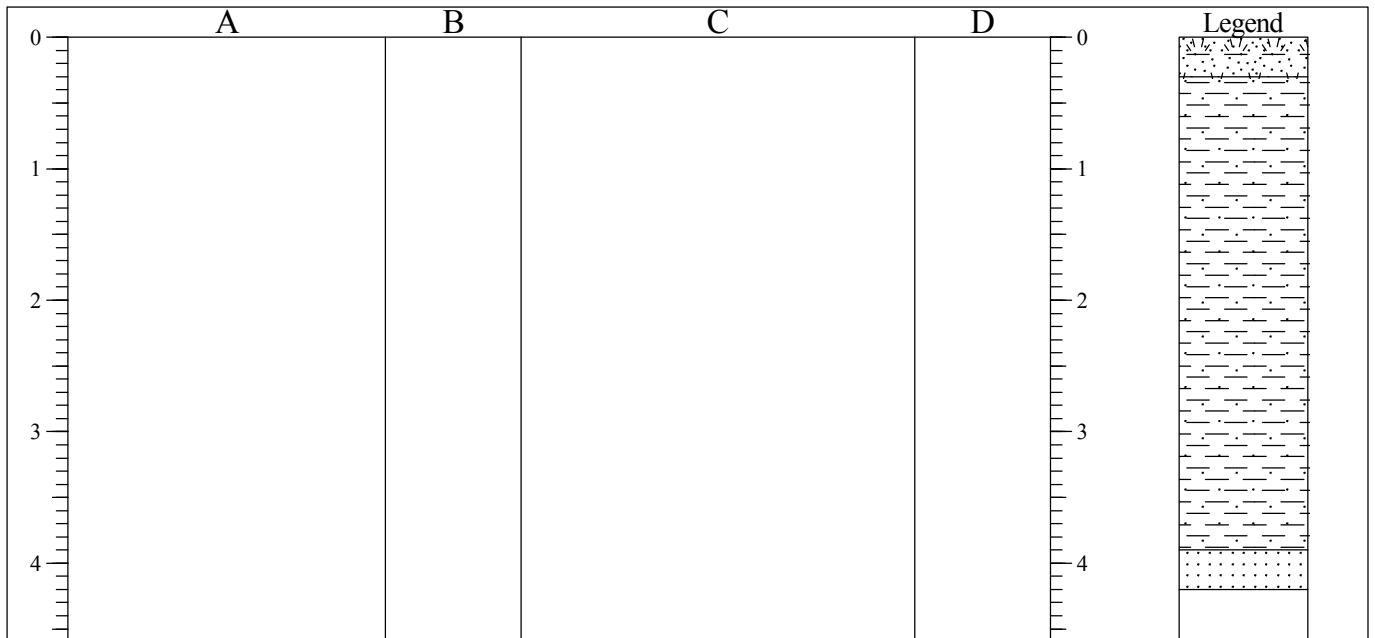
Drillhole	Test Section			Test Pressure (Bar)	Lugeon Value	Interpretation*
	From (m)	To (m)	Length (m)			
LM5	10.00	11.50	1.50	0.90	0.0	No water taken
				1.59	0.0	
				2.28	0.0	
				1.59	0.0	
				0.90	0.0	
LM5	13.04	14.93	1.89	1.94	0.0	Highest lugeon occurs at highest test pressure, suggesting dilation of defects
				3.32	0.3	
				4.36	0.6	
				3.32	0.3	
				1.94	0.0	

* Housby A.C. Routine Interpretation of the Lugeon Water Test. *Q. Jl Engng Geol* **1976**, 9, 303-313.

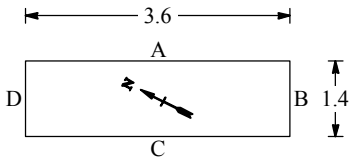
Appendix F: Trial Pit logs and Photograph

TRIAL PIT LOG

Project KCDC				TRIAL PIT No TP MA1
Job No DW909	Date 16-03-10 16-03-10	Ground Level (m) 120.50	Co-Ordinates () E 2,681,748.0 N 6,029,718.0	
Contractor				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		Topsoil			
0.30-3.90		LOESS; Silty CLAY with some fine sand; Compact, Moist, Medium brown, Firm but readily excavated.			
3.90-4.20		GREYWACKE; Moderately weathered, no obvious structural features. Hard to excavate.			
4.20		3.90 Loess/Greywacke contact subparallel to surface End of Hole			

Shoring/Support: None Stability: Hole stable 				GENERAL REMARKS To investigate lithologies on North side of road saddle. Ground surface sloping at approx 10 deg to NW. Levels and co-ordinates based on handheld gps (+/-3m).	
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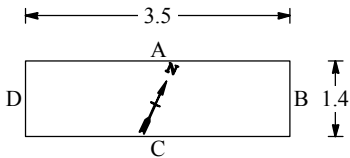
All dimensions in metres Scale 1:57.5	Client Kapiti District Council	Method/ Plant Used 20 tonne excavator	Logged By Royden Thomson
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TRIAL PIT LOG

Project KCDC				TRIAL PIT No TP MA2
Job No DW909	Date 16-03-10 16-03-10	Ground Level (m) 120.00	Co-Ordinates () E 2,681,805.0 N 6,029,663.0	
Contractor				Sheet 1 of 1

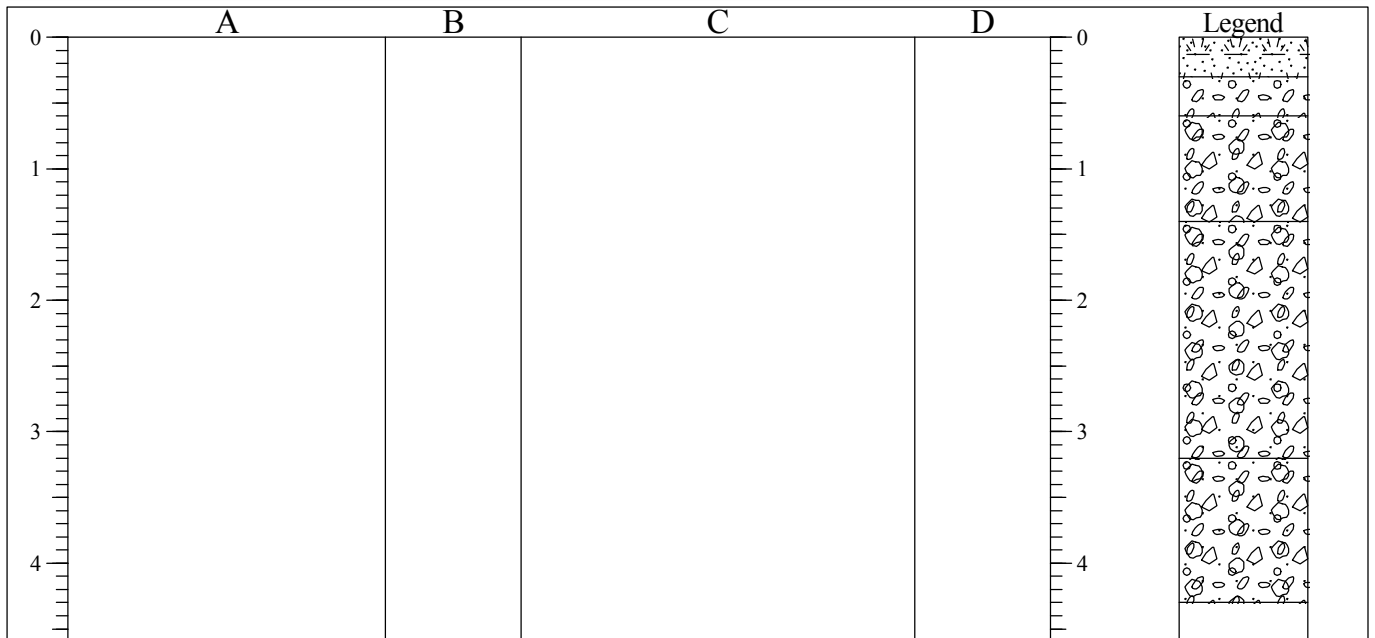
A	B	C	D	Legend
0				
1				
2				
3				
4				

STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		Topsoil			
0.30-1.30		LOESS; Orange brown, massive, firm.			
1.30-2.70		RIVER ALLUVIUM; Dirty, cobbly, sandy GRAVEL (GW). Fines (silt/clay) adhere to surfaces. Clasts are sub angular - sub rounded greywacke. Moist, dark brown.			
2.70-3.70		LAKE DEPOSITS; Clayey SILT (ML) with some very fine sand. Very compact. Firm, mostly light grey. 2.70 Small water inflows			
3.70-4.10		RIVER ALLUVIUM; Dirty, cobbly, sandy GRAVEL (GW). Substantial silt/clay in voids. Clasts are MnO stained. Some cementing.			
4.10		End of Hole			

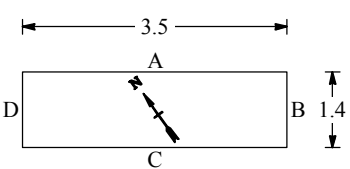
Shoring/Support: None Stability: Hole stable 			GENERAL REMARKS To investigate lithologies on SE side of saddle. Ground sloping at approx 3-4 deg to NE. Alluvial units anticipated to be low k & expected to penetrate through saddle to RL 120 (approx). Levels and co-ordinates based on handheld gps (+/- 3m).	
All dimensions in metres Scale 1:55	Client Kapiti District Council	Method/ Plant Used 20 tonne excavator	Logged By Royden Thomson	

TRIAL PIT LOG

Project KCDC				TRIAL PIT No TP MA3
Job No DW909	Date 16-03-10 16-03-10	Ground Level (m) 109.00	Co-Ordinates () E 2,681,921.0 N 6,029,648.0	
Contractor				Sheet 1 of 1



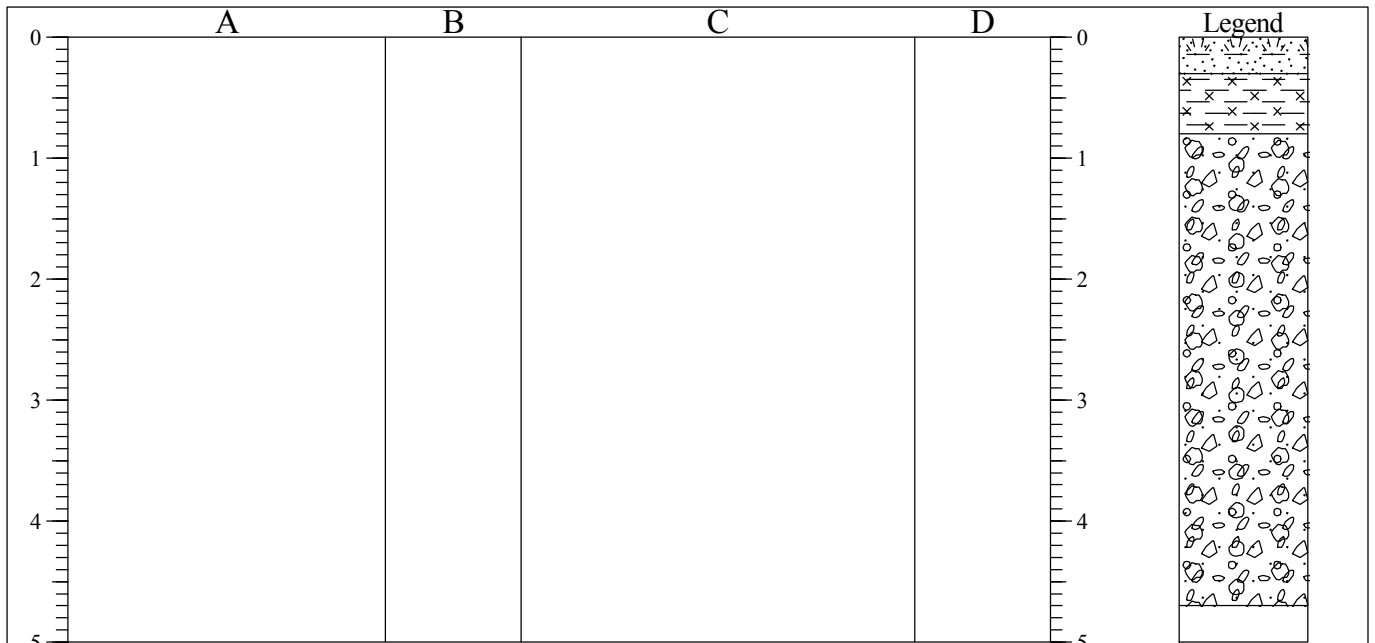
STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		Topsoil			
0.30-0.60		Very dirty (soily) sandy, GRAVEL (GW); Rewatered surficial alluvium.			
0.60-1.40		RIVER ALLUVIUM; Cobbly, sandy, GRAVEL (GW) with rare silt. Clasts are angular - sub rounded greywacke. Loose, dry, medium brown.			
1.40-3.20		RIVER ALLUVIUM; Dirty, sandy, GRAVEL (GW) with some cobbles. Silt/clay largely infills voids. Clasts angular/sub rounded greywacke. Firm, moist, medium brown.			
3.20-4.30		RIVER ALLUVIUM; Dirty, cobbly, sandy, GRAVEL (GW) with some boulders (max 0.70m). Clasts angular - sub rounded greywacke. Hard, only slight clast weathering. Voids largely infilled with clay/silt (clay is tackey - more clay than silt). Medium brown, moist to locally saturated. 3.20 Water seep			
4.30		End of Hole			

Shoring/Support: None Stability: Hole stable 				GENERAL REMARKS To investigate aggregate potential of valley floor alluvium. Ground surface sub horizontal. Alluvium dirty - v. dirty, anticipated to be low k. Levels and co-ordinates based on handheld gps (+/-3m).	
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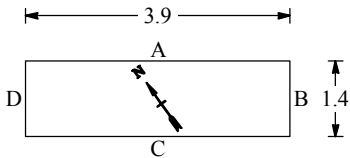
All dimensions in metres Scale 1:57.5	Client Kapiti District Council	Method/ Plant Used 20 tonne excavator	Logged By Royden Thomson
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TRIAL PIT LOG

Project KCDC				TRIAL PIT No TP MA4
Job No DW909	Date 16-03-10 16-03-10	Ground Level (m) 109.00	Co-Ordinates () E 2,681,969.0 N 6,029,614.0	
Contractor				Sheet 1 of 1

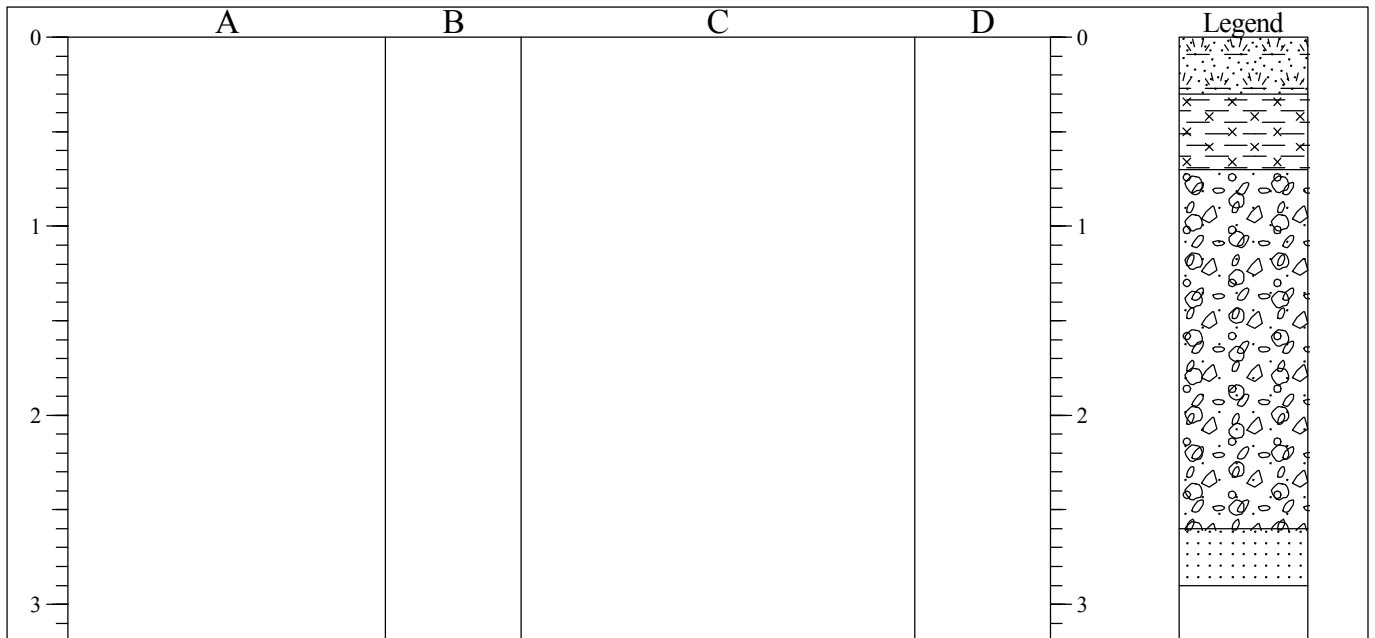


STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		TOPSOIL			
0.30-0.80		LOESS; Light brown.			
0.80-4.70		RIVER ALLUVIUM; Dirty, cobbly, sandy GRAVEL (GW) with rare boulders (max 0.5m). Clasts angular - sub rounded Greywacke. Hard (vw/sw), Fines (silty/clay) tend to infill voids. Tackey. Moist. No inflows. Light to medium brown. Fair horizontally bedded. 3.00 Tends dirtier			
4.70		End of Hole			

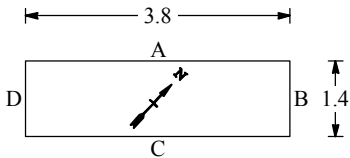
Shoring/Support: None Stability: Hole stable 			GENERAL REMARKS To investigate aggregate potential of valley floor alluvium. Ground surface sub horizontal. Alluvium dirty - v. dirty, anticipated to be low k, relatively uniform grading. Minor clasts with MnO staining. Levels and co-ordinates based on handheld gps (+/- 4m).	
All dimensions in metres Scale 1:62.5	Client Kapiti District Council	Method/ Plant Used 20 tonne excavator	Logged By Royden Thomson	

TRIAL PIT LOG

Project KCDC				TRIAL PIT No TP MA5
Job No DW909	Date 16-03-10 16-03-10	Ground Level (m) 107.00	Co-Ordinates () E 2,682,070.0 N 6,029,879.0	
Contractor				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		TOPSOIL			
0.30-0.70		LOESS; Light brown			
0.70-2.60		RIVER ALLUVIUM; Dirty, cobbly, sandy, GRAVEL (GW) with rare boulders (max 0.4m). Fines (silty/clay) infill voids. Clasts angular - sub rounded, tend fresh. Wet, medium brown. Poorly bedded.			
2.60-2.90		GREYWACKE; Closely jointed, equant debris, slight penetration of fines along defects. Slightly weathered.			
2.90		End of Hole			

Shoring/Support: None Stability: Localised fretting on pit walls. 			GENERAL REMARKS To investigate aggregate potential of valley floor alluvium. Ground surface sub horizontal. Alluvium, anticipated to be low k. Shallow depth to greywacke, greywacke may be suitable for aggregate. Levels and co-ordinates based on hand held GPS (+/-3m). Logged by: Royden Thomson	
All dimensions in metres Scale 1:40	Client Kapiti District Council	Method/ Plant Used 20 tonne excavator		

Trial Pit MA-1:



Trail Pit MA-2:



Trail Pit MA-2:



Trial Pit MA-3:



Trial Pit MA-4:



Trial Pit MA-5:



